Minerals Yearbook

1972

Volume II

AREA REPORTS: DOMESTIC

U.S. DEPARTMENT OF THE INTERIOR
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UNITED STATES DEPARTMENT OF THE INTERIOR • Rogers C. B. Morton, Secretary

BUREAU OF MINES • Thomas V. Falkie, Director

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interests of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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Foreword

For 91 years, the Federal Government, through the medium of the Minerals Yearbook or its predecessor volumes, has reported annually on mineral industry activities. This edition of the Minerals Yearbook presents the record on worldwide mineral industry performance during 1972. In addition to statistical data, the volumes provide sufficient background information to interpret the year's developments. The content of the individual volumes is as follows:

Volume I, Metals, Minerals, and Fuels, contains chapters on virtually all metallic, nonmetallic, and mineral fuel commodities important to the domestic economy. In addition, it includes a general review chapter on the mineral industries, a statistical summary, and a chapter on technologic trends.

Volume II, Area Reports: Domestic, contains chapters on the mineral industry of each of the 50 States, the U.S. island possessions in the Pacific Ocean and the Caribbean Sea, the Commonwealth of Puerto Rico, and the Canal Zone. This volume also has a statistical summary, identical to that in Volume I.

Volume III, Area Reports: International, contains the latest available mineral data on more than 130 foreign countries and discusses the importance of minerals to the economies of these nations. A separate chapter reviews minerals in general and their relationships to the world economy.

The Bureau of Mines continually strives to improve the value of the Yearbook for its users, and toward that end, the constructive comments and suggestions of readers will be welcomed.

THOMAS V. FALKIE, *Director*.

ACKNOWLEDGMENTS

The chapters of this volume, except the statistical summary, were prepared by the staffs of the Divisions of Ferrous Metals, Fossil Fuels, Nonferrous Metals, and Nonmetallic Minerals of the Assistant Directorate, Mineral Supply. The Statistical Summary chapter and the tabular material covering total State mineral production, value of mineral production by county, and economic indicators were prepared in the Office of Technical Data Services. The Minerals Yearbook staff of that office reviewed the manuscripts upon which this volume was based, to insure statistical consistency among the tables, figures, and text between this volume and Volume I, and between this volume and those of former years.

Compilations contained in this volume were based largely on statistical data and other facts provided by the mineral industries. The Bureau gratefully acknowledges the willing contribution of these essential data by both companies and individuals.

In the collection of statistical and other mineral-industry information, the Bureau of Mines was also assisted by various State agencies through cooperative agreements. Many of the chapters in Volume II were reviewed by staff members of these agencies, and in some instances the staff members collaborated in preparing the chapters and are shown as coauthors. Our sincere appreciation for this assistance is extended to the following cooperating organizations:

Alabama: Geological Survey of Alabama.
Alaska: Alaska Department of Natural Resources.
Arizona: Arizona Bureau of Mines.
Arkansas: Arkansas Geological Commission.
California: Division of Mines and Geology, California Department of Conservation.
Connecticut: Connecticut Geological and Natural History Survey.
Delaware: Delaware Geological Survey.
Florida: Florida Bureau of Geology.
Georgia: Earth and Water Division, Georgia Department of Natural Resources.
Hawaii: Hawaii Department of Land and Natural Resources.
Idaho: Idaho Bureau of Mines and Geology.
Illinois: Illinois State Geological Survey.
Indiana: Geological Survey, Indiana Department of Natural Resources.
Iowa: Geological Survey of Iowa.
Kansas: State Geological Survey of Kansas.
Kentucky: Kentucky Geological Survey.
Louisiana: Louisiana Geological Survey.
Maine: Geological Survey of Maine.
Maryland: Maryland Geological Survey.
Massachusetts: Department of Public Works, Commonwealth of Massachusetts.
Michigan: Geological Survey Division, Michigan Department of Natural Resources.
Minnesota: Minnesota Geological Survey.
Mississippi: Mississippi Geological, Economic, and Topographical Survey.
Missouri: Missouri Geological Survey.
Montana: Montana Bureau of Mines and Geology.
Nebraska: Conservation and Survey Division of the University of Nebraska, Nebraska Geological Survey.
Nevada: Nevada Bureau of Mines.
New Hampshire: New Hampshire Department of Resources and Economic Development.

New Jersey: Bureau of Geology and Topography, New Jersey Division of Natural Resources.
New York: New York State Museum and Science Service.
North Carolina: Office of Earth Resources, North Carolina Department of Natural and Economic Resources.
North Dakota: State Geological Survey of North Dakota.
Oklahoma: Oklahoma Geological Survey.
Pennsylvania: Pennsylvania Bureau of Topographic and Geologic Survey, Department of Environmental Resources.
Puerto Rico: Mining Commission of Puerto Rico; Economic Development Administration, Commonwealth of Puerto Rico.
South Carolina: South Carolina Division of Geology, State Development Board.
South Dakota: South Dakota State Geological Survey.
Tennessee: Division of Geology, Tennessee Department of Conservation.
Texas: Bureau of Economic Geology, University of Texas at Austin.
Utah: Utah Geological and Mineralogical Survey.
Vermont: Geological Survey of Vermont.
Virginia: Virginia Division of Mineral Resources.
Washington: Washington Division of Mines and Geology.
West Virginia: West Virginia Geological and Economic Survey.
Wisconsin: Geological and Natural History Survey of Wisconsin.
Wyoming: Geological Survey of Wyoming.

ALBERT E. SCHRECK
Editor-in-Chief

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Statistical Summary

By Staff, Office of Technical Data Services—Mineral Supply

This chapter is a summarization of mineral production data for the United States, its island possessions, the Canal Zone, and the Commonwealth of Puerto Rico. Also included are tables that show the principal mineral commodities exported from and imported into the United States, and that compare world and U.S. mineral production. More detailed data are contained in the commodity chapters of volume I and in the State chapters of volume II of this edition of the Minerals Yearbook.

Mineral production may be measured at any of several stages of extraction and processing. The stage of measurement used in this chapter is what is normally termed "mine output." It usually refers to minerals or ores in the form in which they are first extracted from the ground, but customarily includes the product of auxiliary processing at or near the mines.

Because of inadequacies in the statistics available, some series deviate from the foregoing definition. In the case of gold, silver, copper, lead, zinc, and tin, the quantities are recorded on a mine basis (as the recoverable content of ore sold or treated). However, the values assigned to these quantities are based on the average selling price of refined metal, not the mine value. Mercury is measured as recovered metal and valued at the average New York price for the metal.

The weight or volume units shown are those customarily used in the particular industries producing the commodities. Values shown are in current dollars, with no adjustment made to compensate for changes in the purchasing power of the dollar.

Table 1.—Value of mineral production [1] in the United States, by mineral group

(Millions)

Year	Mineral fuels	Nonmetals (except fuels)	Metals	Total [2]
1968	$16,820	$5,449	$2,698	$24,966
1969	17,965	5,624	3,333	26,921
1970	20,152	[r] 5,712	3,928	[r] 29,792
1971 [r]	21,247	6,058	3,403	30,708
1972	22,084	6,492	3,641	32,217

[r] Revised.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Data may not add to totals shown because of independent rounding.

Table 2.—Mineral production [1] in the United States

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
MINERAL FUELS								
Asphalt and related bitumens (native): Bituminous limestone and sandstone and gilsonite……short tons..	1,918,748	$8,561	1,980,562	$8,879	1,668,928	$8,291	1,995,874	$10,308
Carbon dioxide, natural [e]……thousand cubic feet..	1,194,836	144	1,109,580	191	1,271,995	216	1,228,741	165
Coal:								
Bituminous and lignite [2]……thousand short tons..	560,505	2,795,509	602,932	3,772,662	552,192	3,901,496	595,386	4,561,983
Pennsylvania anthracite……do....	10,473	100,769	9,729	105,841	8,727	108,469	7,106	85,251
Helium:								
Crude……million cubic feet..	3,998	46,843	3,958	46,820	3,988	47,856	3,462	41,544
Grade A……do....	760	21,599	647	17,405	577	14,589	627	15,603
Natural gas……do....	20,698,240	3,455,615	21,920,642	3,745,680	22,493,012	[r]4,085,482	22,531,698	4,208,236
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels..	201,784	603,084	206,805	603,024	200,181	616,657	198,480	604,423
LPG……do....	378,457	498,927	399,611	672,088	417,684	769,397	444,786	847,810
Peat……thousand short tons..	566	7,055	526	5,986	600	7,011	607	7,112
Petroleum (crude)……thousand 42-gallon barrels..	3,371,751	10,426,680	3,517,450	11,173,726	3,453,914	11,692,998	3,455,368	11,706,510
Total mineral fuels……	XX	17,965,000	XX	20,152,000	XX	[r]21,247,000	XX	22,084,000
NONMETALS (EXCEPT FUELS)								
Abrasive stones [3]……short tons..	3,811	600	3,055	635	2,849	563	3,241	670
Asbestos……do....	125,936	10,648	125,814	10,696	130,882	12,174	131,663	13,408
Barite……thousand short tons..	1,077	15,758	854	12,800	825	13,491	906	14,883
Boron minerals……do....	1,020	81,261	1,041	86,827	1,047	89,856	1,121	95,882
Bromine……thousand pounds..	391,883	87,990	349,748	60,560	355,946	61,750	386,864	68,689
Calcium-magnesium chloride……short tons..	W	W	632,500	15,225	W	W	W	W
Cement:								
Portland……thousand short tons..	75,866	1,284,600	71,629	1,268,718	75,881	1,421,888	77,978	1,588,290
Masonry……do....	3,255	69,106	2,978	67,537	3,341	84,556	3,777	100,269
Clays……do....	58,694	264,415	54,858	267,912	56,666	274,431	59,456	308,022
Diatomite……short tons..	598,482	36,485	597,686	32,649	585,318	34,392	576,089	37,554
Feldspar……do....	754,868	8,869	726,069	9,638	742,810	9,969	782,439	10,872
Fluorspar……do....	182,567	8,411	269,221	13,923	272,071	17,263	250,347	17,815
Garnet (abrasive)……do....	20,458	1,874	18,837	1,986	18,984	1,984	18,916	1,957
Gem stones [e]……	NA	2,390	NA	2,396	NA	2,589	NA	2,728
Gypsum……thousand short tons..	9,905	38,854	9,436	35,182	10,418	39,057	12,328	43,504
Lime……do....	20,209	280,786	19,747	286,155	19,591	303,100	20,290	339,304
Magnesium compounds from sea water and brine (except for metal)……short tons, MgO equivalent..	618,762	58,046	707,874	62,434	668,649	62,322	729,472	63,915
Mica:								
Scrap……thousand short tons..	133	2,898	119	2,527	127	2,917	160	4,353
Sheet……pounds..	W	3	--	--	17,005	7	14,280	7
Perlite……short tons..	471,454	5,100	456,184	4,904	482,208	4,941	544,594	6,231
Phosphate rock……thousand short tons..	37,725	208,689	38,739	203,218	38,886	203,828	40,831	207,910
Potassium salts……thousand short tons, K_2O equivalent..	2,804	73,572	2,729	98,123	2,587	100,527	2,659	106,680
Pumice……thousand short tons..	3,609	5,050	3,086	4,671	[r]3,391	[r]5,214	3,818	6,539
Pyrites……thousand long tons..	W	W	W	W	808	7,137	741	6,652

Salt ....thousand short tons..	44,345	287,680	45,896	304,750	44,077	308,687	48,082	296,773
Sand and gravel ....do....	937,160	1,060,667	943,941	1,115,705	919,593	1,148,960	918,375	1,199,530
Sodium carbonate (natural) ....do....	2,513	50,922	2,688	54,820	2,878	60,774	3,218	71,689
Sodium sulfate (natural) ....do....	672	12,427	602	10,982	688	11,008	701	11,306
Stone [4] ....do....	862,095	1,424,094	874,512	1,474,917	r 876,123	r 1,594,065	923,852	1,663,332
Sulfur: Frasch process mines..........thousand long tons..	6,551	176,659	6,419	151,779	r 6,738	r 117,894	7,618	182,335
Talc, soapstone, and pyrophyllite..........short tons..	1,029,238	7,508	1,027,929	7,773	1,037,297	7,634	1,107,404	7,835
Tripoli ....do....	84,678	784	68,105	520	75,184	569	87,864	797
Vermiculite ....thousand short tons..	310	6,805	285	6,501	301	7,198	337	8,092
Value of items that cannot be disclosed: Aplite, brucite (1969–71), natural and slag cement, emery, graphite, iodine, kyanite, lithium minerals, magnesite, greensand marl, olivine, staurolite, wollastonite, and values of nonmetal items indicated by symbol W..................	XX	46,941	XX	r 84,401	XX	r 47,858	XX	39,780
Total nonmetals..................	XX	5,624,000	XX	r 5,712,000	XX	r 6,058,000	XX	6,492,000
METALS								
Antimony ore and concentrate..short tons, antimony content..	938	W	1,130	W	1,025	933	489	386
Bauxite..........thousand long tons, dried equivalent..	1,843	25,725	2,082	30,070	1,988	28,543	1,812	23,238
Copper (recoverable content of ores, etc.)..........short tons..	1,544,579	1,468,400	1,719,657	1,984,484	1,522,183	1,583,071	1,664,840	1,704,796
Gold (recoverable content of ores, etc.)..........troy ounces..	1,733,176	71,944	1,743,322	63,439	1,495,108	61,673	1,449,943	84,967
Iron ore, usable (excluding byproduct iron sinter) thousand long tons, gross weight..	89,854	929,293	87,176	941,739	77,106	891,002	77,884	950,365
Lead (recoverable content of ores, etc.)..........short tons..	509,013	151,635	571,767	178,609	578,550	159,679	618,915	186,046
Manganese ore (35% or more Mn)..short tons, gross weight..	5,630	157	4,737	W	142	W	578	W
Manganiferous ore (5% to 35% Mn)..........do....	430,637	W	368,302	W	198,334	W	147,161	W
Mercury..........76-pound flasks..	29,640	14,969	27,296	11,130	r 17,883	r 5,229	7,286	1,590
Molybdenum (content of concentrate).....thousand pounds..	103,009	173,819	110,381	190,077	97,882	164,917	102,197	170,530
Nickel (content of ore and concentrate)..........short tons..	17,056	W	15,933	W	17,036	W	16,864	W
Rare-earth metal concentrates..........do....	W	W	W	W	17,194	7,538	19,520	8,479
Silver (recoverable content of ores, etc.) thousand troy ounces..	41,906	75,040	45,006	79,697	41,564	64,258	37,233	62,737
Titanium concentrate, ilmenite.....short tons, gross weight..	893,034	18,636	920,964	18,626	r 713,610	r 15,936	725,728	16,265
Tungsten ore and concentrate...short tons, 60% WO_3 basis..	8,312	18,770	9,785	23,790	7,173	20,184	7,401	18,104
Uranium (recoverable content U_3O_8)......thousand pounds..	23,748	142,161	24,682	149,464	r 24,515	r 151,996	25,758	162,272
Vanadium (recoverable in ore and concentrate)...short tons..	5,577	26,334	5,319	34,923	5,252	37,690	4,887	30,867
Zinc (recoverable content of ores, etc.)..........do....	553,124	161,512	534,136	163,650	r 491,407	r 158,234	478,318	169,803
Value of items that cannot be disclosed: Beryllium, cobalt (1969–71), columbium-tantalum concentrate (1969), magnesium chloride for magnesium metal, manganiferous residuum, platinum-group metals (crude), tin (content of concentrates), titanium concentrate (rutile 1972), zircon concentrates, and value of metal items indicated by symbol W..................	XX	54,180	XX	58,430	XX	51,690	XX	50,664
Total metals..................	XX	3,333,000	XX	3,928,000	XX	r 3,403,000	XX	3,641,000
Grand total mineral production..................	XX	26,921,000	XX	r 29,792,000	XX	r 30,708,000	XX	32,217,000

e Estimate. r Revised. NA Not available.

W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Includes a small quantity of anthracite mined in States other than Pennsylvania. In 1971, value excluded that of Arizona, which is withheld to avoid disclosing individual company confidential data; value included with "Nonmetal items that cannot be disclosed."

[3] Grindstones, pulpstones, grinding pebbles, sharpening stones, and tube mill liners.

[4] Excludes abrasive stone, bituminous limestone, bituminous sandstone, and soapstone, all included elsewhere in table.

Table 3.—Minerals produced in the United States and principal producing States in 1972

Mineral	Principal producing States, in order of quantity	Other producing States
Antimony ore and concentrate	Idaho, Mont., Nev.	
Aplite	Va.	
Asbestos	Calif., Vt., Ariz., N.C.	
Asphalt (native)	Tex., Utah, Ala., Mo.	
Barite	Nev., Mo., Ark., Alaska	Calif., Ga., Tenn.
Bauxite	Ark., Ala., Ga.	
Beryllium concentrate	Utah, S. Dak., Colo.	
Boron minerals	Calif.	
Bromine	Ark., Mich., Calif.	
Calcium-magnesium chloride	Mich., Calif.	
Carbon dioxide (natural)	N. Mex., Colo., Calif., Utah.	
Cement	Calif., Pa., Tex., Mich	Ala., Ariz., Ark., Colo., Fla., Ga., Hawaii, Idaho, Ill., Ind., Iowa, Kans., Ky., La., Maine, Md., Minn., Miss., Mo., Mont., Nebr., Nev., N. Mex., N.Y., N.C., Ohio, Okla., Oreg., S.C., S. Dak., Tenn., Utah, Va., Wash., W. Va., Wis., Wyo.
Clays	Ga., Tex., Ohio, N.C	All other States except Alaska, R.I., Vt.
Coal	W. Va., Ky., Pa., Ill	Ala., Alaska, Ariz., Ark., Colo., Ind., Iowa, Kans., Md., Mo., Mont., N. Mex., N. Dak., Ohio, Okla., Tenn., Tex., Utah, Va., Wash., Wyo.
Copper (mine)	Ariz., Utah, N. Mex., Mont	Calif., Colo., Idaho, Maine, Mich., Mo., Nev., Okla., Oreg., Pa., Tenn., Wash.
Diatomite	Calif., Nev., Wash., Ariz	Oreg.
Emery	N.Y.	
Feldspar	N.C., Calif., Conn., S.C	Ariz., Colo., Ga., S. Dak., Wyo.
Fluorspar	Ill., Colo., Ky., Tex	Ariz., Mont., Nev., N. Mex., Utah.
Garnet, abrasive	N.Y., Idaho.	
Gold (mine)	Nev., S. Dak., Utah, Ariz	Alaska, Calif., Colo., Idaho, Mont., N. Mex., Oreg., Tenn., Wash.
Graphite	Tex.	
Gypsum	Mich., Tex., Calif., Iowa	Ariz., Ark., Colo., Ind., Kans., La., Mont., Nev., N. Mex., N.Y., Ohio, Okla., S. Dak., Utah, Va., Wash., Wyo.
Helium	Kans., Tex., Okla., Ariz.	
Iodine	Mich.	
Iron Ore	Minn., Mich., Calif., Mo	Ala., Ariz., Colo., Ga., Idaho, Mont., Nev., N. Mex., N.Y., N.C., Pa., Tex., Utah, Wis., Wyo.
Kyanite	Va., Ga., Fla.	
Lead (mine)	Mo., Idaho, Colo., Utah	Ariz., Calif., Ill., Maine, Mont., Nev., N. Mex., N.Y., Va., Wash., Wis.
Lime	Ohio, Mo., Pa., Tex	Ala., Ariz., Ark., Calif., Colo., Conn., Fla., Hawaii, Idaho, Ill., Ind., Iowa, Kans., Ky., La., Md., Mass., Mich., Minn., Miss., Mont., Nebr., Nev., N.J., N. Mex., N.Y., N. Dak., Okla., Oreg., S. Dak., Tenn., Utah, Va., Wash., W. Va., Wis., Wyo.
Lithium minerals	N.C., Nev., Calif.	
Magnesite	Nev.	
Magnesium chloride	Tex., Utah.	
Magnesium compounds	Mich., Calif., Fla., N.J	Del., Miss., Tex., Utah.
Manganese ore	Mont.	
Manganiferous ore	Minn., N. Mex.	
Manganiferous residuum	N.J.	
Marl, greensand	N.J.	
Mercury	Calif., Nev., Alaska, Idaho	N.Y., Tex.
Mica, scrap	N.C., Ala., Ga., S.C	Ariz., Conn., N. Mex., Pa., S. Dak.
Mica, sheet	Colo.	
Molybdenum	Colo., Ariz., N. Mex., Utah	Calif., Nev.
Natural gas	Tex., La., Okla., N. Mex	Ala., Alaska, Ariz., Ark., Calif., Colo., Fla., Ill., Ind., Kans., Ky., Md., Mich., Miss., Mo., Mont., Nebr., N.Y., N. Dak., Ohio, Pa., Tenn., Utah, Va., W. Va., Wyo.
Natural gas liquids	Tex., La., Okla., N. Mex	Ala., Alaska, Ark., Calif., Colo., Fla., Ill., Kans., Ky., Mich., Miss., Mont., Nebr., N. Dak., Pa., Utah, W. Va., Wyo.
Nickel	Oreg.	
Olivine	Wash., N.C.	

Table 3.—Minerals produced in the United States and principal producing States in 1972—Continued

Mineral	Principal producing States, in order of quantity	Other producing States
Peat	Mich., Ill., Fla., Ind.	Calif., Colo., Ga., Iowa, Maine, Md., Mass., Minn., Mont., N.J., N. Mex., N.Y., Ohio, Pa., S.C., Vt., Wash., Wis.
Perlite	N. Mex., Ariz., Calif., Nev.	Colo., Idaho, Tex.
Petroleum, crude	Tex., La., Calif., Okla.	Ala., Alaska, Ariz., Ark., Colo., Fla., Ill., Ind., Kans., Ky., Mich., Miss., Mo., Mont., Nebr., Nev., N. Mex., N.Y., N. Dak., Ohio, Pa., S. Dak., Tenn., Utah, Va., W. Va., Wyo.
Phosphate rock	Fla., Idaho, Tenn., N.C.	Mont., Utah, Wyo.
Platinum-group metals	Alaska.	
Potassium salts	N. Mex., Calif., Utah.	
Pumice	Oreg., Ariz., Calif., Hawaii	Colo., Idaho, Kans., Nebr., Nev., N. Mex., N. Dak., Okla., Tex., Utah, Wash., Wyo.
Pyrites ore and concentrate	Tenn., Colo., Ariz.	
Rare-earth metal concentrates	Calif., Ga., Fla.	
Salt	La., Tex., Ohio, N.Y.	Ala., Calif., Colo., Hawaii, Kans., Mich., Nev., N. Mex., N. Dak., Okla., Utah., Va., W. Va.
Sand and gravel	Calif., Mich., Ohio, Ill.	All other States.
Silver (mine)	Idaho, Ariz., Utah, Colo.	Alaska, Calif., Ill., Maine, Mich., Mo., Mont., Nev., N. Mex., N.Y., Okla., Oreg., S. Dak., Tenn., Wash.
Sodium carbonate (natural)	Wyo., Calif.	
Sodium sulfate (natural)	Calif., Tex.	Utah.
Staurolite	Fla.	
Stone	Pa., Ill., Fla., Tex.	All other States except Del.
Sulfur (Frasch)	Tex., La.	
Talc, soapstone, pyrophyllite	N.Y., Tex., Vt., Calif.	Ala., Ark., Ga., Md., Mont., Nev., N.C., Oreg., Va., Wash.
Tin	Colo., Alaska.	
Titanium concentrate	N.Y., Fla., N.J., Ga.	
Tripoli	Ill., Okla., Ark., Pa.	
Tungsten concentrate	Calif., Colo., Nev., Mont.	Ariz., Idaho, Oreg., Utah, Wash.
Uranium	N. Mex., Wyo., Tex., Colo.	Alaska, S. Dak., Utah, Wash.
Vanadium	Ark., Colo., Idaho, Utah	N. Mex., S. Dak.
Vermiculite	Mont., S.C.	
Wollastonite	N.Y.	
Zinc (mine)	Tenn., Colo., Mo., N.Y.	Ariz., Calif., Idaho, Ill., Ky., Maine, Mont., N.J., N. Mex., Okla., Pa., Utah, Va., Wash., Wis.
Zircon concentrate	Fla., Ga.	

Table 4.—Value of mineral production in the United States and principal minerals produced in 1972

State	Value (thousands)	Rank	Percent of U.S. total	Principal minerals, in order of value
Alabama	$371,241	21	1.15	Coal, cement, stone, petroleum.
Alaska	286,138	25	.89	Petroleum, natural gas, sand and gravel, coal.
Arizona	1,091,004	8	3.39	Copper, molybdenum, sand and gravel, cement.
Arkansas	241,179	29	.75	Petroleum, bromine, natural gas, stone.
California	1,851,365	3	5.75	Petroleum, cement, natural gas, sand and gravel.
Colorado	425,841	19	1.32	Petroleum, molybdenum, coal, sand and gravel.
Connecticut	33,123	45	.10	Stone, sand and gravel, feldspar, lime.
Delaware	2,871	50	.01	Sand and gravel, magnesium compounds, clays.
Florida	424,287	20	1.32	Phosphate rock, stone, cement, petroleum.
Georgia	258,041	28	.80	Clays, stone, cement, sand and gravel.
Hawaii	28,074	46	.09	Stone, cement, sand and gravel, pumice.
Idaho	106,206	36	.33	Silver, lead, phosphate rock, zinc.
Illinois	769,737	10	2.39	Coal, petroleum, stone, sand and gravel.
Indiana	322,608	22	1.00	Coal, cement, stone, sand and gravel.
Iowa	134,496	31	.42	Cement, stone, sand and gravel, gypsum.
Kansas	584,537	15	1.81	Petroleum, natural gas, natural gas liquids, cement.
Kentucky	976,910	9	3.03	Coal, stone, petroleum, natural gas.
Louisiana	5,411,543	2	16.80	Petroleum, natural gas, natural gas liquids, sulfur.
Maine	22,922	47	.07	Cement, sand and gravel, stone, zinc.
Maryland	115,501	33	.36	Stone, cement, sand and gravel, coal.
Massachusetts	52,428	43	.16	Sand and gravel, stone, lime, clays.
Michigan	694,767	13	2.16	Iron ore, cement, copper, sand and gravel.
Minnesota	659,669	14	2.05	Iron ore, sand and gravel, stone, cement.
Mississippi	260,681	27	.81	Petroleum, natural gas, sand and gravel, cement.
Missouri	451,817	18	1.40	Lead, cement, stone, iron ore.
Montana	307,676	24	.96	Copper, petroleum, sand and gravel, coal.
Nebraska	73,675	41	.23	Petroleum, cement, sand and gravel, stone.
Nevada	181,702	30	.56	Copper, gold, sand and gravel, diatomite.
New Hampshire	10,111	48	.03	Sand and gravel, stone, clays, gem stones.
New Jersey	113,760	34	.35	Stone, sand and gravel, zinc, magnesium compounds.
New Mexico	1,097,292	7	3.41	Petroleum, natural gas, copper, potassium salts.
New York	320,453	23	.99	Cement, stone, salt, sand and gravel.
North Carolina	116,323	32	.36	Stone, sand and gravel, cement, phosphate rock.
North Dakota	98,086	37	.30	Petroleum, coal, sand and gravel, natural gas.
Ohio	724,748	12	2.25	Coal, stone, lime, cement.
Oklahoma	1,210,728	6	3.76	Petroleum, natural gas, natural gas liquids, cement.
Oregon	76,516	40	.24	Sand and gravel, stone, cement, nickel.
Pennsylvania	1,231,485	5	3.82	Coal, cement, stone, sand and gravel.
Rhode Island	4,291	49	.01	Sand and gravel, stone, gem stones.
South Carolina	82,313	39	.26	Cement, stone, sand and gravel, clays.
South Dakota	65,200	42	.20	Gold, sand and gravel, stone, cement.
Tennessee	269,814	26	.84	Coal, stone, cement, zinc.
Texas	7,211,551	1	22.38	Petroleum, natural gas, natural gas liquids, cement.
Utah	542,809	16	1.68	Copper, petroleum, coal, gold.
Vermont	34,868	44	.11	Stone, sand and gravel, asbestos, talc.
Virginia	489,791	17	1.52	Coal, stone, cement, sand and gravel.
Washington	109,806	35	.34	Cement, sand and gravel, stone, coal.
West Virginia	1,430,632	4	4.44	Coal, natural gas, stone, cement.
Wisconsin	89,353	38	.28	Sand and gravel, stone, iron ore, cement.
Wyoming	746,743	11	2.32	Petroleum, sodium carbonate, natural gas, uranium.
Total	**32,217,000**	--	**100.00**	

Table 5.—Value of mineral production per capita and per square mile, by State

State	Area (square miles)	1970 Population (thousands)	Value of mineral production				
			Total (thousands)	Per square mile		Per capita	
				(Thousands)	Rank	(Dollars)	Rank
Alabama	51,609	3,444	$371,241	$7,193	20	$108	20
Alaska	586,412	300	286,138	488	50	954	4
Arizona	113,909	1,771	1,091,004	9,578	14	616	7
Arkansas	53,104	1,923	241,179	4,542	29	125	18
California	158,693	19,953	1,851,365	11,666	12	93	25
Colorado	104,247	2,207	425,841	4,085	32	193	14
Connecticut	5,009	3,032	33,123	6,613	23	11	47
Delaware	2,057	548	2,871	1,396	42	5	49
Florida	58,560	6,789	424,287	7,245	19	62	31
Georgia	58,876	4,590	258,041	4,383	30	56	33
Hawaii	6,450	769	28,074	4,353	31	37	37
Idaho	83,557	713	106,206	1,271	44	149	17
Illinois	56,400	11,114	769,737	13,648	9	69	28
Indiana	36,291	5,194	322,608	8,889	16	62	32
Iowa	56,290	2,824	134,496	2,389	36	48	35
Kansas	82,264	2,247	584,537	7,106	21	260	13
Kentucky	40,395	3,219	976,910	24,184	5	303	12
Louisiana	48,523	3,641	5,411,543	111,525	1	1,486	2
Maine	33,215	992	22,922	690	49	23	41
Maryland	10,577	3,922	115,501	10,920	13	29	40
Massachusetts	8,257	5,689	52,428	6,350	27	9	48
Michigan	58,216	8,875	694,767	11,934	11	78	27
Minnesota	84,068	3,805	659,669	7,847	17	173	15
Mississippi	47,716	2,217	260,681	5,463	28	118	19
Missouri	69,686	4,677	451,817	6,484	24	97	24
Montana	147,138	694	307,676	2,091	38	443	10
Nebraska	77,227	1,483	73,675	954	46	50	34
Nevada	110,540	489	181,702	1,644	39	372	11
New Hampshire	9,304	738	10,111	1,087	45	14	46
New Jersey	7,836	7,168	113,760	14,518	8	16	45
New Mexico	121,666	1,016	1,097,292	9,019	15	1,080	3
New York	49,576	18,237	320,453	6,464	25	18	44
North Carolina	52,586	5,082	116,323	2,212	37	23	42
North Dakota	70,665	618	98,086	1,388	43	159	16
Ohio	41,222	10,652	724,748	17,582	6	68	30
Oklahoma	69,919	2,559	1,210,728	17,316	7	473	9
Oregon	96,981	2,091	76,516	789	48	37	36
Pennsylvania	45,333	11,794	1,231,485	27,165	3	104	22
Rhode Island	1,214	947	4,291	3,535	34	5	50
South Carolina	31,055	2,591	82,313	2,651	35	32	39
South Dakota	77,047	666	65,200	846	47	98	23
Tennessee	42,244	3,924	269,814	6,387	22	69	29
Texas	267,338	11,197	7,211,551	26,975	4	644	6
Utah	84,916	1,059	542,809	6,392	26	513	8
Vermont	9,609	444	34,868	3,629	33	79	26
Virginia	40,817	4,648	489,791	12,000	10	105	21
Washington	68,192	3,409	109,806	1,610	40	32	38
West Virginia	24,181	1,744	1,430,632	59,163	2	820	5
Wisconsin	56,154	4,418	89,353	1,591	41	20	43
Wyoming	97,914	332	746,743	7,627	18	2,249	1
Total	**3,615,055**	**202,455**	**32,217,000**	**8,912**	--	**159**	--

Table 6.—Mineral production[1] in the United States, by State

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
ALABAMA								
Cement:[2]								
Masonry thousand short tons	364	$8,520	336	$7,601	349	$8,657	407	$11,221
Portland do	3,107	51,251	3,018	51,114	2,284	42,281	2,860	48,577
Clays do	3,097	7,083	2,748	8,213	[3]2,915	[3]6,918	2,850	7,512
Coal (bituminous) do	17,456	130,405	20,560	166,308	17,944	146,180	20,818	200,430
Iron ore (usable) thousand long tons, gross weight	1,125	6,435	W	W	415	2,778	827	1,912
Lime thousand short tons	747	9,870	749	10,286	761	11,454	789	11,751
Natural gas million cubic feet	180	24	627	87	355	54	8,644	1,282
Petroleum (crude) thousand 42-gallon barrels	7,701	20,793	7,268	20,627	7,882	23,496	9,984	30,466
Sand and gravel thousand short tons	8,828	9,427	6,725	8,144	6,674	7,518	6,352	8,530
Stone do	19,854	37,512	[4]19,982	37,166	17,778	34,418	18,485	42,027
Value of items that cannot be disclosed: Asphalt (native), bauxite, cement (slag), mica (scrap), natural gas liquids, phosphate rock (1969–70), salt, stone (dimension) (1970–72), talc and values indicated by symbol W	XX	3,416	XX	18,699	XX	7,758	XX	7,533
Total	XX	284,736	XX	328,245	XX	291,492	XX	371,241
ALASKA								
Antimony ore and concentrate short tons, antimony content	12	13	63	109	--	--	--	--
Barite thousand short tons	W	W	184	835	102	1,075	W	W
Coal (bituminous) do	667	4,366	549	4,059	698	5,710	668	W
Gem stones	NA	W	NA	W	NA	W	NA	57
Gold (recoverable content of ores, etc.) troy ounces	21,227	881	34,776	1,265	13,012	537	8,689	506
Lead (recoverable content of ores, etc.) short tons	2	1	--	--	--	--	--	--
Natural gas million cubic feet	50,864	12,665	111,576	27,448	121,618	[r]17,878	125,596	18,463
Petroleum (crude) thousand 42-gallon barrels	73,953	214,464	83,616	251,684	79,494	257,562	72,898	235,444
Sand and gravel thousand short tons	16,205	18,615	25,825	41,092	28,617	32,806	14,187	15,214
Silver (recoverable content of ores, etc.) thousand troy ounces	2	4	2	4	1	1	(5)	(5)
Stone thousand short tons	1,954	3,902	6,470	10,014	2,658	5,066	652	3,012
Tin long tons	W	W	W	W	17	47	W	W
Value of items that cannot be disclosed: Natural gas liquids (1969, 1971–72), platinum-group metals, uranium (1971–72), and values indicated by symbol W	XX	2,865	XX	1,761	XX	[r]2,141	XX	13,442
Total	XX	257,776	XX	338,271	XX	322,823	XX	286,138
ARIZONA								
Clays thousand short tons	120	394	199	454	[3]119	[3]84	[3]134	[3]355
Coal (bituminous) do	--	--	182	W	1,146	W	W	W
Copper short tons	801,368	761,840	917,918	1,059,277	820,171	852,978	908,612	930,419
Diatomite do	725	W	W	W	W	W	W	W
Gem stones	NA	158	NA	155	NA	160	NA	168
Gold (recoverable content of ores, etc.) troy ounces	110,878	4,603	109,853	3,998	94,088	3,879	102,996	6,036

Gypsum ....thousand short tons..	88	424	95	358	W	W	W	W
Helium, high purity..........million cubic feet .	64	1,126	62	1,186	W	W	W	W
Iron ore (usable)........thousand long tons, gross weight..	18	136	W	W	[r]16	W	W	W
Lead (recoverable content of ores, etc.)..........short tons..	217	65	285	89	859	287	1,763	580
Lime..........thousand short tons..	288	5,074	309	4,523	296	4,474	356	6,024
Mercury..........76-pound flasks..	W	W	--	--	--	--	--	--
Molybdenum (content of concentrate).....thousand pounds..	12,639	20,947	15,672	26,700	22,684	39,872	27,216	46,791
Natural gas (marketed)..........million cubic feet..	1,186	199	1,101	188	868	153	W	W
Petroleum (crude)..........thousand 42-gallon barrels..	2,433	7,056	1,784	5,281	1,236	3,918	998	3,226
Pumice..........thousand short tons..	910	814	824	627	949	625	915	722
Sand and gravel..........do....	16,744	18,224	17,822	19,804	19,791	24,391	24,842	32,420
Silver (recoverable content of ores, etc.).thousand troy ounces..	6,141	10,997	7,330	12,981	6,170	9,538	6,653	11,210
Stone..........thousand short tons..	2,827	5,812	3,511	7,094	2,873	5,848	4,638	8,018
Tungsten ore and concentrate...short tons, 60% WO_3 basis..	1	2	W	W	W	W	W	W
Uranium (recoverable content U_3O_8)......thousand pounds..	W	W	--	--	--	--	--	--
Zinc (recoverable content of ores, etc.)..........short tons..	9,039	2,639	9,618	2,947	7,761	2,499	10,111	3,589
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite, 1971; fire, 1972), feldspar, fluorspar (1971–72), mica (scrap), perlite, pyrites, vanadium (1969), vermiculite (1969), and values indicated by symbol W..........	XX	18,957	XX	21,105	XX	32,864	XX	41,496
Total..........	XX	859,462	XX	1,166,767	XX	981,020	XX	1,091,004
		ARKANSAS						
Barite..........thousand short tons..	210	4,616	168	3,721	W	W	W	W
Bauxite..........thousand long tons, dried equivalent...	1,755	24,706	1,869	26,298	1,781	24,979	1,634	21,010
Bromine and bromine in compounds......thousand pounds..	145,100	28,287	W	W	W	W	W	W
Clays..........thousand short tons..	992	2,426	1,014	2,902	[3]936	[3]1,499	[3]885	[3]990
Coal (bituminous)..........do....	228	1,802	268	2,225	276	2,848	428	4,676
Gem stones..........	NA	24	NA	25	NA	30	NA	32
Lime..........thousand short tons..	184	2,748	186	2,680	157	2,318	150	2,456
Natural gas..........million cubic feet..	169,257	26,743	181,351	29,560	172,154	29,426	166,522	28,808
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels..	692	2,049	643	1,824	517	1,686	261	854
LPG..........do....	1,279	2,098	1,205	2,482	1,035	2,650	546	1,420
Petroleum (crude)..........do....	18,049	51,079	18,035	51,760	18,263	56,805	18,519	58,335
Sand and gravel..........thousand short tons..	12,674	14,949	13,801	16,036	11,630	15,603	11,574	16,558
Stone..........do....	16,463	23,134	15,284	22,786	[r]17,647	[r]28,776	16,317	25,020
Value of items that cannot be disclosed: Abrasive stones, cement, clays (kaolin), gypsum, mercury (1970–71), soapstone, tripoli, vanadium, and values indicated by symbol W.	XX	23,465	XX	63,331	XX	79,703	XX	81,020
Total..........	XX	208,126	XX	225,625	XX	[r]246,318	XX	241,179
		CALIFORNIA						
Antimony ore and concentrate..short tons, antimony content..	--	--	4	10	--	--	--	--
Asbestos..........short tons..	75,828	5,956	78,966	6,332	87,144	7,806	90,967	8,673
Barite..........thousand short tons..	W	W	W	W	W	W	4	84
Boron minerals..........do....	1,020	81,261	1,041	86,827	1,047	89,856	1,121	95,882
Cement: Portland..........do....	9,477	170,612	9,306	173,126	9,117	169,921	9,086	182,306
Clays..........do....	2,993	7,443	2,824	6,506	[3]2,822	[3]7,103	2,706	7,387

See footnotes at end of table.

Table 6.—Mineral production [1] in the United States, by State—Continued

Mineral	1969		1970		1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
CALIFORNIA—Continued								
verable content of ores, etc.)........short tons..	1,129	$1,073	2,308	$2,663	515	$536	598	$612
Gem stones....................................	NA	200	NA	200	NA	205	NA	215
Gold (recoverable content of ores, etc.).........troy ounces..	7,904	328	4,999	182	2,966	122	3,974	238
Gypsum..........................thousand short tons..	1,210	3,339	1,132	3,271	1,352	3,884	1,525	4,965
Lead (recoverable content of ores, etc.) ....short tons..	2,518	750	1,772	558	2,284	630	1,153	347
Lime.............................thousand short tons..	585	9,666	572	9,911	630	10,846	608	13,059
Magnesium compounds from seawater and bitterns (partly estimated) ....short tons, MgO equivalent..	76,220	7,143	73,726	7,489	152,918	16,836	175,654	18,421
Mercury.........................76-pound flasks..	13,430	9,333	13,598	7,582	[r] 13,489	[r] 3,944	5,788	1,263
Natural gas.......................million cubic feet..	677,689	207,440	649,117	208,367	612,629	199,717	487,278	179,318
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels..	12,954	39,944	11,998	38,478	11,045	35,545	8,468	27,664
LPG.....................................do....	8,238	17,646	7,051	16,006	6,755	16,482	5,847	15,962
Peat ....thousand short tons..	11	106	10	W	12	W	29	620
Perlite.....................................do....	11,419	105	W	W	W	W	W	W
Petroleum (crude)...............thousand 42-gallon barrels..	375,291	920,060	372,191	945,365	358,484	975,076	347,022	940,430
Pumice...........................thousand short tons..	666	1,229	499	832	699	1,179	731	1,507
Salt...do....	1,395	W	1,656	15,058	1,887	21,142	1,621	14,860
Sand and gravel ....do....	124,718	155,883	140,259	174,221	115,468	157,688	117,288	162,619
Silver (recoverable content of ores, etc.) thousand troy ounces..	492	881	451	799	444	686	175	296
Stone............................thousand short tons..	38,088	57,757	46,399	66,950	43,336	86,255	37,218	65,811
Talc, soapstone and pyrophyllite.................short tons..	145,158	2,329	184,660	2,545	158,227	2,084	155,155	1,186
Zinc (recoverable content of ores, etc.)..............do....	3,327	971	3,514	1,077	3,008	967	1,202	427
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, carbon dioxide, cement (masonry, 1971–72), coal (lignite), diatomite, feldspar, iron ore, lithium minerals, molybdenum, phosphate rock (1969–70), potassium salts, rare-earth metal concentrates, sodium carbonate and sulfate, tungsten concentrate, wollastonite (1969), and values indicated by symbol W..........................	XX	143,208	XX	125,337	XX	112,218	XX	107,266
Total..	XX	1,844,663	XX	1,899,682	XX	[r] 1,920,723	XX	1,851,365
COLORADO								
Beryllium concentrate...........................short tons..	46	W	W	W	W	W	W	W
Carbon dioxide, natural..............thousand cubic feet..	175,787	30	W	W	W	W	W	W
Clays...........................thousand short tons..	732	1,619	[2] 637	[2] 1,508	625	1,334	747	1,533
Coal (bituminous)...............................do....	5,530	29,121	6,025	35,243	5,337	33,818	5,522	35,687
Copper (recoverable content of ores, etc.)........short tons..	3,598	3,421	3,749	4,326	3,938	4,096	3,944	4,089
Feldspar.......................................do....	[r] 407	3	[r] 477	3	[r] 571	4	W	W
Gem stones.....................................	NA	122	NA	120	NA	125	NA	131
Gold (recoverable content of ores, etc.).........troy ounces..	25,777	1,070	37,114	1,351	42,031	1,734	61,100	3,580
Gypsum..........................thousand short tons..	94	339	W	W	W	W	W	W
Lead (recoverable content of ores, etc.)..........short tons..	21,767	6,484	21,855	6,827	25,746	7,106	31,346	9,423

Gypsum .... thousand short tons..	83	424	98	858	W	W	W	W
Helium, high purity .... million cubic feet..	56	1,126	62	1,186	W	W	W	W
Iron ore (usable) .... thousand long tons, gross weight..	18	186	W	W	[r]16	W	W	W
Lead (recoverable content of ores, etc.) .... short tons..	217	65	285	89	859	237	1,768	580
Lime .... thousand short tons..	283	5,074	309	4,523	296	4,474	856	6,024
Mercury .... 76-pound flasks..	W	W	--	--	--	--	--	--
Molybdenum (content of concentrate) .... thousand pounds..	12,699	20,947	15,672	26,700	22,684	39,872	27,216	46,791
Natural gas (marketed) .... million cubic feet..	1,186	199	1,101	188	868	158	W	W
Petroleum (crude) .... thousand 42-gallon barrels..	2,483	7,056	1,784	5,281	1,236	8,918	993	3,226
Pumice .... thousand short tons..	910	814	824	627	949	625	915	722
Sand and gravel .... do....	16,744	18,224	17,822	19,804	19,791	24,391	24,842	32,420
Silver (recoverable content of ores, etc.) . thousand troy ounces..	6,141	10,997	7,380	12,981	6,170	9,538	6,653	11,210
Stone .... thousand short tons..	2,827	5,812	3,511	7,094	2,873	5,848	4,638	8,018
Tungsten ore and concentrate ... short tons, 60% WO_3 basis..	1	2	W	W	W	W	W	W
Uranium (recoverable content U_3O_8) .... thousand pounds..	W	W	--	--	--	--	--	--
Zinc (recoverable content of ores, etc.) .... short tons..	9,089	2,689	9,618	2,947	7,761	2,499	10,111	3,589
Value of items that cannot be disclosed: Asbestos, cement, clays (bentonite, 1971; fire, 1972), feldspar, fluorspar (1971–72), mica (scrap), perlite, pyrites, vanadium (1969), vermiculite (1969), and values indicated by symbol W	XX	18,957	XX	21,105	XX	32,864	XX	41,496
Total	XX	859,462	XX	1,166,767	XX	981,020	XX	1,091,004
		ARKANSAS						
Barite .... thousand short tons..	210	4,616	168	3,721	W	W	W	W
Bauxite .... thousand long tons, dried equivalent..	1,755	24,706	1,869	26,298	1,781	24,979	1,684	21,010
Bromine and bromine in compounds .... thousand pounds..	145,100	28,287	W	W	W	W	W	W
Clays .... thousand short tons..	992	2,426	1,014	2,902	[3]936	[3]1,499	[3]885	[3]990
Coal (bituminous) .... do....	228	1,802	268	2,225	276	2,848	428	4,676
Gem stones	NA	24	NA	25	NA	30	NA	32
Lime .... thousand short tons..	184	2,748	186	2,680	157	2,318	150	2,456
Natural gas .... million cubic feet..	169,257	26,743	181,851	29,560	172,154	29,426	166,522	28,808
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels..	692	2,049	643	1,824	517	1,686	261	854
LPG .... do....	1,279	2,098	1,205	2,482	1,085	2,650	546	1,420
Petroleum (crude) .... do....	18,049	51,079	18,085	51,760	18,268	56,805	18,519	58,835
Sand and gravel .... thousand short tons..	12,674	14,949	13,801	16,086	11,680	15,608	11,574	16,558
Stone .... do....	16,463	23,134	15,284	22,786	[r]17,647	[r]28,776	16,317	25,020
Value of items that cannot be disclosed: Abrasive stones, cement, clays (kaolin), gypsum, mercury (1970–71), soapstone, tripoli, vanadium, and values indicated by symbol W.	XX	23,465	XX	63,831	XX	79,708	XX	81,020
Total	XX	208,126	XX	225,625	XX	[r]246,818	XX	241,179
		CALIFORNIA						
Antimony ore and concentrate .. short tons, antimony content..	--	--	4	10	--	--	--	--
Asbestos .... short tons..	75,828	5,956	78,966	6,882	87,144	7,806	90,967	8,673
Barite .... thousand short tons..	W	W	W	W	W	W	4	34
Boron minerals .... do....	1,020	81,261	1,041	86,827	1,047	89,856	1,121	95,882
Cement: Portland .... do....	9,477	170,612	9,806	178,126	9,117	169,921	9,086	182,308
Clays .... do....	2,993	7,443	2,824	6,506	[3]2,822	[3]7,108	2,706	7,387

See footnotes at end of table.

Table 6.—Mineral production [1] in the United States, by State—Continued

Mineral	1969		1970		1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
CALIFORNIA—Continued								
Copper (recoverable content of ores, etc.)........short tons..	1,129	$1,073	2,308	$2,663	515	$536	598	$612
Gem stones..................................	NA	200	NA	200	NA	205	NA	215
Gold (recoverable content of ores, etc.)..........troy ounces..	7,904	328	4,999	182	2,966	122	3,974	233
Gypsum..........................thousand short tons..	1,210	3,339	1,132	3,271	1,352	3,884	1,525	4,965
Lead (recoverable content of ores, etc.)..........short tons..	2,518	750	1,772	553	2,284	630	1,153	347
Lime............................thousand short tons..	585	9,666	572	9,911	630	10,846	608	13,059
Magnesium compounds from seawater and bitterns (partly estimated).................short tons, MgO equivalent..	76,220	7,143	73,726	7,489	152,918	16,836	175,654	18,421
Mercury..............................76-pound flasks..	18,480	9,333	18,593	7,582	r 13,489	r 3,944	5,788	1,263
Natural gas.........................million cubic feet..	677,689	207,440	649,117	208,367	612,629	199,717	487,278	179,318
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels..	12,954	39,944	11,993	38,478	11,045	35,545	8,468	27,664
LPG...do....	8,238	17,646	7,051	16,006	6,755	16,482	5,847	15,962
Peat............................thousand short tons..	11	106	10	W	12	W	29	620
Perlite...do....	11,419	105	W	W	W	W	W	W
Petroleum (crude)..............thousand 42-gallon barrels..	375,291	920,060	372,191	945,365	358,484	975,076	347,022	940,430
Pumice..........................thousand short tons..	866	1,229	499	832	699	1,179	731	1,507
Salt..do....	1,895	W	1,656	15,053	1,887	21,142	1,621	14,860
Sand and gravel...................................do....	124,718	155,883	140,259	174,221	115,468	157,683	117,288	162,619
Silver (recoverable content of ores, etc.) thousand troy ounces..	492	881	451	799	444	686	175	296
Stone...........................thousand short tons..	38,033	57,757	46,399	66,950	43,336	86,255	37,213	65,811
Talc, soapstone and pyrophyllite..............short tons..	145,158	2,329	184,660	2,545	153,227	2,084	155,155	1,186
Zinc (recoverable content of ores, etc.)..............do....	3,327	971	3,514	1,077	3,003	967	1,202	427
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, carbon dioxide, cement (masonry, 1971–72), coal (lignite), diatomite, feldspar, iron ore, lithium minerals, molybdenum, phosphate rock (1969–70), potassium salts, rare-earth metal concentrates, sodium carbonate and sulfate, tungsten concentrate, wollastonite (1969), and values indicated by symbol W..........................	XX	143,208	XX	125,337	XX	112,218	XX	107,266
Total..	XX	1,844,663	XX	1,899,682	XX	r 1,920,723	XX	1,851,365
COLORADO								
Beryllium concentrate..........................short tons..	46	W	W	W	W	W	W	W
Carbon dioxide, natural..............thousand cubic feet..	175,737	30	W	W	W	W	W	W
Clays..............................thousand short tons..	732	1,619	[3] 637	[3] 1,506	625	1,334	747	1,533
Coal (bituminous)...................................do....	5,530	29,121	6,025	35,243	5,337	33,813	5,522	35,687
Copper (recoverable content of ores, etc.).......short tons..	3,598	3,421	3,749	4,326	3,938	4,096	3,944	4,039
Feldspar..do....	r 407	3	r 477	3	r 571	4	W	W
Gem stones..	NA	122	NA	120	NA	125	NA	131
Gold (recoverable content of ores, etc.).........troy ounces..	25,777	1,070	37,114	1,351	42,031	1,734	61,100	3,580
Gypsum..........................thousand short tons..	94	339	W	W	W	W	W	W
Lead (recoverable content of ores, etc.)..........short tons..	21,767	6,484	21,855	6,827	25,746	7,106	31,846	9,423

Lime……thousand short tons..	127	2,449	119	1,613	193	3,089	187	4,070
Mica, sheet……pounds..	--	--	--	--	8,300	4	14,230	7
Molybdenum……thousand pounds..	62,411	105,846	W	W	W	W	W	W
Natural gas……million cubic feet..	118,754	17,219	105,804	15,553	106,587	16,982	116,949	19,297
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels..	1,076	2,798	745	1,937	929	2,462	1,245	3,249
LPG……do....	1,782	2,762	1,542	2,529	1,653	3,190	1,749	3,678
Peat……thousand short tons..	26	160	34	210	28	156	39	210
Petroleum (crude)……thousand 42-gallon barrels..	28,294	88,277	24,723	78,619	27,891	92,855	32,015	109,171
Pumice……thousand short tons..	42	232	50	268	62	W	39	W
Pyrites……thousand long tons..	24	120	W	W	W	W	W	W
Sand and gravel……thousand short tons..	19,877	27,266	22,261	24,190	27,000	30,155	28,318	34,631
Silver (recoverable content of ores, etc.) thousand troy ounces..	2,599	4,653	2,933	5,194	3,390	5,241	3,664	6,174
Stone……thousand short tons..	2,245	5,079	3,552	8,076	3,785	7,933	4,507	9,599
Tin (content of concentrate)……long tons..	44	119	W	W	W	W	W	W
Tungsten concentrate……short tons, 60% WO_3 basis..	1,941	4,440	W	W	W	W	W	W
Uranium (recoverable content U_3O_8)……thousand pounds..	2,736	16,935	2,727	15,882	2,536	15,725	1,877	11,825
Vanadium (recoverable in ore and concentrate)…short tons..	W	W	W	W	W	W	W	W
Zinc (recoverable content of ores, etc.)……do....	58,715	15,685	56,694	17,370	61,181	19,700	63,801	22,649
Value of items that cannot be disclosed: Cement, fluorspar, iron ore, scrap mica (1970–71), perlite, rare-earth metal concentrates (1969), salt and values indicated by symbol W..	XX	32,745	XX	169,060	XX	147,117	XX	146,843
Total……	XX	368,494	XX	389,824	XX	392,721	XX	425,841
CONNECTICUT								
Clays……thousand short tons..	197	341	171	386	174	322	157	292
Gem stones……	NA	8	NA	8	NA	15	NA	16
Mica, scrap……thousand short tons..	W	W	W	W	3	W	2	W
Sand and gravel……do....	8,857	10,359	6,765	9,202	6,921	10,262	6,768	11,270
Stone……do....	7,562	15,325	8,338	16,915	7,193	15,649	8,719	19,695
Value of items that cannot be disclosed: Feldspar, lime, and values indicated by symbol W……	XX	1,734	XX	1,872	XX	1,713	XX	1,850
Total……	XX	27,767	XX	28,383	XX	27,961	XX	33,123
DELAWARE								
Clays……thousand short tons..	11	11	11	11	14	8	15	9
Gem stones……	NA	1	NA	1	NA	2	NA	W
Sand and gravel……thousand short tons..	2,257	2,074	1,565	1,603	2,205	2,231	2,257	2,660
Value of items that cannot be disclosed: Other nonmetals and values indicated by symbol W……	--	--	--	--	--	--	XX	202
Total……	XX	2,086	XX	1,615	XX	2,241	XX	2,871
FLORIDA								
Cement:								
Masonry……thousand short tons..	W	W	W	W	180	4,877	218	6,901
Portland……do....	W	W	W	W	2,177	48,970	2,425	59,778
Clays……do....	907	13,627	872	12,661	[3]998	12,834	[3]922	10,336

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
FLORIDA—Continued								
Lime thousand short tons	182	$2,712	167	$2,810	159	$2,958	180	$3,527
Natural gas million cubic feet	50	8	--	--	903	270	15,521	4,967
Peat thousand short tons	55	359	46	304	57	412	45	362
Petroleum (crude) thousand 42-gallon barrels	1,731	W	2,999	W	5,347	W	16,897	W
Sand and gravel thousand short tons	14,409	13,988	12,482	12,254	23,228	18,836	20,752	15,025
Stone [4] do	42,332	56,611	43,089	61,302	42,816	64,332	53,093	81,621
Value of items that cannot be disclosed: Kaolin (1971–72), kyanite, magnesium compounds, natural gas liquids, phosphate rock, staurolite, stone (dimension limestone 1969–70, shell 1972), titanium concentrate, zircon concentrate and values indicated by symbol W	XX	208,071	XX	210,711	XX	190,242	XX	241,775
Total	XX	295,876	XX	300;042	XX	343,781	XX	424,287
GEORGIA								
Barite thousand short tons	124	3,116	W	W	W	W	W	W
Cement:								
Masonry do	W	W	W	W	63	1,470	68	1,569
Portland do	W	W	W	W	1,214	22,470	1,260	27,286
Clays do	5,670	98,462	5,684	110,149	[3] 5,791	[3] 119,096	[3] 6,227	[3] 132,322
Iron ore (usable) thousand long tons, gross weight	241	1,338	243	1,467	W	W	W	W
Peat thousand short tons	W	W	W	W	1	13	W	W
Sand and gravel do	3,824	4,709	3,667	4,437	3,697	5,310	3,816	4,729
Stone do	27,755	59,451	26,635	59,200	30,669	69,397	37,074	82,484
Talc short tons	47,790	301	45,900	289	53,000	334	45,842	338
Value of items that cannot be disclosed: Bauxite, fire clay (1971–72), feldspar, kyanite, scrap mica, rare-earth metal concentrates, titanium concentrate, zircon concentrate, and values indicated by symbol W	XX	23,525	XX	27,683	XX	[r] 10,895	XX	9,318
Total	XX	190,902	XX	203,225	XX	[r] 229,485	XX	258,041
HAWAII								
Cement:								
Masonry thousand short tons	--	--	11	366	11	431	13	384
Portland do	390	10,544	396	9,968	375	10,196	402	10,732
Clays do	2	9	2	11	W	W	W	W
Gem stones	W	W	W	W	NA	54	NA	57
Lime thousand short tons	9	287	9	338	8	228	7	266
Pumice, pumicite, and volcanic ash do	403	783	350	938	289	779	379	762
Sand and gravel do	552	1,816	514	1,679	336	1,967	609	1,398
Stone do	6,584	16,059	[4] 6,332	15,588	[4] 6,056	14,357	[4] 5,005	13,494
Value of items that cannot be disclosed: Salt, and value of items indicated by symbol W	XX	41	XX	182	XX	[r] 95	XX	486

Total	XX	29,589	XX	28,965	XX	28,107	XX	28,074
IDAHO								
Antimony ore and concentrate short tons, antimony content	922	W	998	W	857	817	845	808
Clays thousand short tons	[2]23	[2]51	[2]13	[2]28	W	W	57	415
Copper (recoverable content of ores, etc.) short tons	3,332	3,168	3,612	4,168	3,776	3,927	2,942	3,018
Gem stones	NA	90	NA	90	NA	100	NA	105
Gold (recoverable content of ores, etc.) troy ounces	3,408	141	3,128	114	3,596	148	2,884	139
Lead (recoverable content of ores, etc.) short tons	65,597	19,541	61,211	19,121	66,610	18,884	61,407	18,459
Mercury 76-pound flasks	1,012	511	1,088	423	1,057	309	161	85
Peat thousand short tons	1	W	W	W	W	W	--	--
Phosphate rock do	W	W	W	W	W	W	W	W
Pumice do	21	62	53	94	W	W	W	W
Sand and gravel do	8,555	7,583	12,958	10,022	11,279	11,437	7,696	10,294
Silver (recoverable content of ores, etc.) thousand troy ounces	18,980	33,897	19,115	33,849	19,140	29,590	14,251	24,012
Stone thousand short tons	3,750	6,426	[4]4,240	[4]6,368	4,149	6,118	3,094	7,042
Tungsten concentrate short tons, 60% WO_3 basis	27	63	W	W	25	66	W	W
Zinc (recoverable content of ores, etc.) short tons	55,900	16,323	41,052	12,578	45,078	14,515	38,647	18,720
Value of items that cannot be disclosed: Cement, clays, (fire clay and kaolin 1969–71), fluorspar (1971), abrasive garnet, iron ore, lime, perlite, stone (dimension 1970), vanadium and values indicated by symbol W	XX	30,453	XX	32,904	XX	26,869	XX	28,639
Total	XX	118,309	XX	119,759	XX	112,280	XX	106,206
ILLINOIS								
Cement:								
Portland thousand short tons	1,639	29,996	1,494	25,252	1,425	25,975	1,571	33,124
Masonry do	84	2,187	71	1,874	73	2,336	80	2,483
Clays [3] do	1,868	4,821	1,676	3,862	1,788	4,294	1,716	3,314
Coal (bituminous) do	64,722	279,712	65,119	320,705	58,402	318,878	65,523	402,481
Fluorspar short tons	88,480	4,676	148,208	8,687	138,051	9,883	182,405	9,961
Gem stones	NA	W	NA	W	NA	2	NA	2
Lead (recoverable content of ores, etc.) short tons	791	236	1,532	479	1,238	342	1,335	401
Natural gas million cubic feet	3,800	586	4,850	761	498	r 139	1,194	334
Peat thousand short tons	67	958	63	711	72	W	74	935
Petroleum (crude) thousand 42-gallon barrels	50,724	161,802	43,747	141,994	39,084	135,621	34,874	121,018
Sand and gravel thousand short tons	44,188	56,688	43,926	60,155	45,864	59,397	39,929	61,696
Stone do	54,857	81,818	55,776	86,502	[4]61,991	[4]106,084	[4]56,260	[4]94,225
Zinc (recoverable content of ores, etc.) short tons	13,765	4,019	16,797	5,146	12,706	4,091	11,378	4,089
Value of items that cannot be disclosed: Clay (fuller's earth), lime, natural gas liquids, silver (1971–72), tripoli and values indicated by symbol W	XX	33,916	XX	32,619	XX	33,830	XX	35,729
Total	XX	659,815	XX	688,697	XX	r 700,870	XX	769,737
INDIANA								
Abrasive stones short tons	5	17	W	W	W	W	W	W
Cement thousand short tons	[2]2,725	[2]45,264	[2]2,151	[2]41,810	W	W	W	W
Clays do	1,488	2,264	1,335	2,139	[3]1,324	r 2,308	1,419	2,465
Coal (bituminous) do	20,086	82,902	22,263	102,871	21,396	110,796	25,949	144,688

See footnotes at end of table.

Table 6.—Mineral production [1] in the United States, by State—Continued

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
INDIANA—Continued								
Natural gas..............million cubic feet..	171	$40	153	$36	537	[r] $89	355	$55
Peat..............thousand short tons..	38	515	W	W	50	W	45	478
Petroleum (crude)..............thousand 42-gallon barrels..	7,841	25,018	7,487	23,958	6,658	22,770	6,180	20,964
Sand and gravel..............thousand short tons..	26,218	27,438	23,476	25,796	24,982	29,094	27,978	33,290
Stone..............do....	25,559	45,400	25,818	45,215	26,233	48,218	27,511	50,919
Value of items that cannot be disclosed: Cement (masonry, 1969–70), gypsum, lime, and values indicated by symbol W..	XX	13,018	XX	14,461	XX	[r] 68,246	XX	69,749
Total..............	XX	241,871	XX	255,786	XX	[r] 281,521	XX	322,608
IOWA								
Cement:								
Portland..............thousand short tons..	2,648	47,265	2,396	45,432	2,392	47,925	2,458	49,635
Masonry..............do....	85	1,912	78	1,758	66	1,719	66	1,916
Clays..............do....	1,199	1,660	1,181	1,823	[3] 1,028	[3] 1,702	1,047	2,643
Coal (bituminous)..............do....	908	3,392	987	4,059	989	4,609	851	4,188
Gem stones..............	W	W	W	W	W	W	NA	1
Gypsum..............thousand short tons..	1,169	5,274	1,186	4,223	1,154	4,460	1,380	5,714
Sand and gravel..............do....	18,391	17,867	21,058	20,642	18,279	20,580	17,107	20,140
Stone..............do....	26,233	40,895	25,305	41,119	[4] 25,389	[4] 44,977	27,457	48,642
Value of items that cannot be disclosed: Clay (fire, 1971), lime, peat, and dimension stone (1971)..............	XX	1,665	XX	1,766	XX	1,899	XX	1,667
Total..............	XX	119,930	XX	120,822	XX	127,821	XX	134,496
KANSAS								
Cement:								
Portland..............thousand short tons..	1,836	29,365	1,729	28,177	1,731	29,961	1,889	35,432
Masonry..............do....	49	1,023	46	1,029	50	1,232	59	1,452
Clays..............do....	[3] 797	[3] 1,070	[3] 718	[3] 946	879	1,151	1,170	1,457
Coal (bituminous)..............do....	1,313	7,108	1,627	9,102	1,151	6,579	1,227	7,835
Helium:								
Crude..............million cubic feet..	2,669	32,667	2,250	30,600	2,510	30,120	2,273	27,276
High purity..............do....	330	7,578	354	8,187	342	7,182	384	8,064
Lead (recoverable content of ores, etc.)..............short tons..	395	118	80	25	--	--	--	--
Lime..............thousand short tons..	7	W	6	W	8	W	9	172
Natural gas..............million cubic feet..	883,156	122,759	899,955	125,994	885,144	127,267	889,268	127,859
Natural gas liquids:								
Natural gasoline..............thousand 42-gallon barrels..	4,855	11,848	6,549	14,617	5,387	12,258	5,505	13,170
LPG..............do....	19,574	26,229	20,814	30,597	23,215	39,001	25,099	43,170
Petroleum (crude)..............do....	88,716	283,891	84,853	277,469	78,532	276,433	78,744	259,578
Pumice..............thousand short tons..	W	W	W	W	W	W	W	W
Salt [6]..............do....	1,270	17,090	1,230	18,206	1,240	18,712	1,369	20,562
Sand and gravel..............do....	12,029	10,061	12,968	12,351	11,862	11,351	11,591	10,920

Stone ....do	15,828	22,645	15,161	22,406	[4]14,908	23,697	[4]14,547	[4]23,849
Zinc (recoverable content of ores, etc.) ....short tons	1,900	555	1,186	364	--	--	--	--
Value of items that cannot be disclosed: Natural cement (1969), clays (1969-70), gypsum, salt (brine), and values indicated by symbol W	XX	3,808	XX	3,969	XX	4,505	XX	3,741
Total	XX	577,815	XX	583,989	XX	589,444	XX	584,537
KENTUCKY								
Clays [3] ....thousand short tons	1,232	2,076	1,020	1,793	956	1,877	920	1,406
Coal (bituminous) ....do	109,049	450,950	125,305	711,163	119,889	774,785	121,188	824,691
Natural gas ....million cubic feet	81,304	20,407	77,892	19,161	72,723	18,253	63,648	15,976
Petroleum (crude) ....thousand 42-gallon barrels	12,924	40,194	11,575	36,461	10,692	35,925	9,702	32,599
Sand and gravel ....thousand short tons	8,364	9,628	8,760	10,474	8,202	11,061	8,485	11,967
Stone [4] ....do	30,158	44,644	29,310	45,208	32,514	52,296	34,279	59,690
Zinc (recoverable content of ores, etc.) ....short tons	W	W	4,189	1,283	5,268	1,696	1,780	632
Value of items that cannot be disclosed: Cement, ball clay, fluorspar, lime (1971-72), natural gas liquids, stone, and values indicated by symbol W	XX	23,148	XX	21,922	XX	30,542	XX	29,949
Total	XX	591,047	XX	847,465	XX	925,885	XX	976,910
LOUISIANA								
Clays ....thousand short tons	1,078	2,943	1,080	1,575	1,073	1,606	1,000	1,454
Lime ....do	822	10,750	1,025	12,811	960	17,625	908	19,614
Natural gas ....million cubic feet	7,227,826	1,387,743	7,788,276	1,508,137	8,081,907	1,632,545	7,972,678	1,626,426
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels	53,565	171,434	56,526	174,632	54,424	173,425	52,842	167,768
LPG ....do	71,867	96,302	80,885	133,262	90,271	166,099	98,238	185,660
Petroleum (crude) ....do	844,608	2,791,269	906,907	3,061,558	985,243	3,359,710	891,827	3,201,659
Salt ....thousand short tons	12,435	61,102	13,584	64,854	13,852	67,950	13,514	67,464
Sand and gravel ....do	18,131	21,895	18,155	22,363	19,228	24,492	18,920	26,996
Stone [4] ....do	9,237	11,892	9,183	11,945	9,688	14,139	9,190	14,836
Sulfur (Frasch process) ....thousand long tons	3,999	108,299	3,618	89,489	[r]3,646	W	3,765	W
Value of items that cannot be disclosed: Cement, gypsum, miscellaneous stone, and values indicated by symbol W	XX	21,697	XX	21,695	XX	[r]94,739	XX	99,666
Total	XX	4,685,326	XX	5,102,321	XX	[r]5,552,330	XX	5,411,543
MAINE								
Clays [3] ....thousand short tons	42	56	41	55	42	56	40	57
Copper ....short tons	W	W	2,703	3,120	2,510	2,610	1,220	1,249
Gem stones	NA	35	NA	35	NA	40	NA	W
Lead ....short tons	--	--	--	--	--	--	85	26
Peat ....thousand short tons	W	W	W	W	2	W	2	99
Sand and gravel ....do	11,275	6,026	12,971	6,888	8,292	5,881	11,818	7,535
Silver ....thousand troy ounces	W	W	63	112	41	64	16	27
Stone ....thousand short tons	1,101	3,798	W	W	1,133	2,913	1,078	2,996
Zinc (recoverable contents of ores, etc.) ....short tons	W	W	9,114	2,792	5,850	1,884	5,820	2,066

See footnotes at end of table.

Table 6.—Mineral production [1] in the United States, by State—Continued

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
MAINE—Continued								
Value of items that cannot be disclosed: Beryllium (1969–70), cement, clays, feldspar (1969–70), and values indicated by symbol W	XX	$10,278	XX	$10,778	XX	$8,450	XX	$8,867
Total	XX	20,188	XX	23,780	XX	21,898	XX	22,922
MARYLAND								
Clays [2] ... thousand short tons	1,152	1,369	1,129	1,488	1,027	1,558	1,104	2,121
Coal (bituminous) ... do	1,368	5,261	1,615	8,088	1,644	10,274	1,640	8,961
Gem stones	NA	3	NA	3	NA	8	NA	8
Natural gas ... million cubic feet	978	248	818	202	214	r 43	244	51
Peat ... thousand short tons	4	78	4	47	3	39	3	29
Sand and gravel ... do	14,230	21,226	12,951	20,484	12,842	23,201	12,594	26,557
Stone ... do	15,067	30,504	16,015	32,788	15,912	34,770	19,431	41,978
Value of items that cannot be disclosed: Cement, selected clays, diatomite (1969), lime, greensand marl, potassium salts (1968–70), and talc and soapstone	XX	24,794	XX	25,231	XX	29,527	XX	35,801
Total	XX	83,483	XX	88,216	XX	r 99,420	XX	115,501
MASSACHUSETTS								
Clays ... thousand short tons	332	624	284	582	186	377	219	416
Gem stones	NA	2	NA	2	NA	r 5	NA	5
Lime ... thousand short tons	199	3,718	W	W	W	W	W	W
Peat ... do	W	W	W	W	2	32	W	W
Sand and gravel ... do	19,456	22,950	17,925	22,244	17,843	23,058	18,883	25,655
Stone ... do	7,847	22,521	8,136	24,349	7,816	23,582	7,990	23,500
Value of items that cannot be disclosed: Nonmetals and values indicated by symbol W	XX	28	XX	3,183	XX	r 3,145	XX	2,852
Total	XX	49,848	XX	50,360	XX	50,199	XX	52,428
MICHIGAN								
Cement:								
Portland ... thousand short tons	5,710	98,425	5,605	101,019	6,108	104,665	5,901	111,410
Masonry ... do	266	5,478	218	5,258	239	5,872	250	5,959
Clays ... do	2,667	3,037	2,480	2,887	2,458	3,366	2,514	3,715
Copper (recoverable content of ores, etc.) ... short tons	75,226	71,516	67,548	77,945	56,005	58,245	67,260	68,874
Gem stones	NA	W	NA	W	NA	8	NA	8
Gypsum ... thousand short tons	1,827	5,384	1,812	5,061	1,488	5,585	1,650	7,267
Iron ore (usable) ... thousand long tons, gross weight	14,058	169,756	13,100	168,958	11,888	159,854	12,692	177,461
Lime ... thousand short tons	1,589	20,372	1,588	21,855	1,444	20,549	1,509	22,758
Magnesium compounds from sea water and brine (except for								

metal) short tons, MgO equivalent	381,191	30,843	411,911	38,050	372,918	37,777	377,675	31,484
Natural gas million cubic feet	36,169	9,294	38,851	10,378	25,662	6,776	34,221	10,506
Natural gas liquids:								
Natural gasoline thousand 42-gallon barrels	921	2,481	599	1,611	553	1,513	395	1,097
LPG do	1,197	2,561	1,176	2,764	975	2,623	888	2,274
Peat thousand short tons	186	2,724	167	1,896	202	2,497	219	2,190
Petroleum (crude) thousand 42-gallon barrels	12,213	37,494	11,693	36,246	11,808	38,850	12,990	41,556
Salt thousand short tons	4,819	45,961	4,899	49,963	4,458	49,007	4,358	50,761
Sand and gravel do	58,092	58,963	53,092	54,646	56,613	62,898	59,467	65,445
Silver (recoverable content of ores, etc.) thousand troy ounces	1,009	1,807	892	1,579	670	1,086	785	1,823
Stone thousand short tons	29,186	43,572	41,687	49,501	40,705	49,240	39,754	50,317
Value of items that cannot be disclosed: Bromine, calcium-magnesium chloride, iodine, and potassium salts (1969–70)	XX	58,818	XX	41,622	XX	r 40,266	XX	40,867
Total	XX	667,986	XX	670,729	XX	640,686	XX	694,767
MINNESOTA								
Clays thousand short tons	³ 275	³ 412	227	335	223	335	³ 167	³ 251
Gem stones	W	W	W	W	NA	18	NA	14
Iron ore (usable) thousand long tons, gross weight	56,957	570,446	54,791	571,488	49,054	547,607	50,595	601,869
Manganiferous ore (5% to 35% Mn) short tons, gross weight	381,491	W	321,436	W	169,782	W	119,824	W
Peat thousand short tons	12	249	14	335	W	W	W	W
Sand and gravel do	48,121	40,191	46,851	38,802	44,916	37,645	36,792	33,454
Stone do	5,085	14,253	4,579	12,311	5,888	14,346	5,757	16,318
Value of items that cannot be disclosed: Abrasive stones, cement, clays (selected, 1969, 1972), lime, and values indicated by symbol W	XX	10,085	XX	9,735	XX	r 8,830	XX	7,763
Total	XX	685,636	XX	633,006	XX	608,776	XX	659,669
MISSISSIPPI								
Clays thousand short tons	1,703	8,660	1,558	8,062	2,278	8,501	1,919	7,837
Natural gas million cubic feet	181,234	23,097	126,081	23,190	118,805	24,880	103,989	28,077
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels	565	1,572	544	1,465	W	W	W	W
LPG do	538	799	428	964	W	W	W	W
Petroleum (crude) do	64,383	187,514	65,119	194,706	64,086	201,808	61,100	192,465
Sand and gravel thousand short tons	11,484	12,263	10,859	11,950	11,289	13,526	13,419	16,183
Stone do	W	W	W	W	r 726	r 709	1,185	1,199
Value of items that cannot be disclosed: Cement, lime, magnesium compounds, and values indicated by symbol W	XX	9,279	XX	9,636	XX	12,790	XX	14,970
Total	XX	243,184	XX	249,973	XX	r 262,164	XX	260,681
MISSOURI								
Barite thousand short tons	304	4,220	230	3,555	232	3,608	218	3,637
Cement:								
Portland do	4,009	74,868	3,990	64,261	4,515	77,568	4,277	80,898
Masonry do	60	1,319	56	1,234	73	1,629	80	1,859
Clays ³ do	2,251	6,405	2,128	6,480	2,354	7,454	2,571	9,096
Coal (bituminous) do	3,801	14,283	4,447	19,526	4,086	19,670	4,551	23,667

See footnotes at end of table.

Table 6.—Mineral production [1] in the United States, by State—Continued

Mineral	1969		1970		1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
MISSOURI—Continued								
Copper (recoverable content of ores, etc.) short tons	12,664	$12,099	12,184	$14,008	8,445	$8,783	11,509	$11,785
Iron ore (usable) thousand long tons, gross weight	2,622	85,826	2,612	88,100	2,727	W	2,695	W
Lead (recoverable content of ores, etc.) short tons	355,452	105,889	421,764	181,751	429,634	118,579	489,397	147,118
Natural gas million cubic feet	126	17	87	21	22	5	9	2
Petroleum (crude) thousand 42-gallon barrels	67	W	66	W	66	W	60	W
Sand and gravel thousand short tons	10,940	14,574	12,446	15,879	10,327	15,109	10,082	14,806
Silver (recoverable content of ores, etc.) thousand troy ounces	1,442	2,582	1,817	3,218	1,661	2,568	1,972	3,822
Stone thousand short tons	41,977	63,251	39,726	[4] 57,285	41,099	[4] 64,772	42,478	[4] 68,219
Zinc (recoverable content of ores, etc.) short tons	41,099	12,001	50,721	15,540	48,215	15,525	61,928	21,988
Value of items that cannot be disclosed: Native asphalt, lime, and values indicated by symbol W	XX	20,458	XX	22,643	XX	64,821	XX	70,480
Total	XX	367,282	XX	392,996	XX	400,089	XX	451,817
MONTANA								
Antimony short tons	--	--	W	W	135	81	W	W
Clays [3] thousand short tons	34	63	41	71	264	1,712	304	1,590
Coal (bituminous and lignite) do	1,030	2,199	3,447	6,394	7,064	12,817	8,221	16,690
Copper (recoverable content of ores, etc.) short tons	103,314	98,219	120,412	138,955	88,581	92,125	123,110	126,064
Gem stones	NA	109	NA	109	NA	114	NA	120
Gold (recoverable content of ores, etc.) troy ounces	24,189	1,004	22,456	817	15,613	644	23,725	1,390
Iron ore (usable) thousand long tons, gross weight	13	W	14	W	14	W	9	W
Lead (recoverable content of ores, etc.) short tons	1,753	522	996	311	615	169	287	86
Lime thousand short tons	255	2,737	208	W	199	2,416	242	3,003
Manganese ore and concentrate (35% or more Mn) short tons, gross weight	775	26	512	W	142	W	578	W
Natural gas million cubic feet	41,229	4,205	42,705	4,399	32,720	3,959	33,474	4,117
Petroleum (crude) thousand 42-gallon barrels	43,954	118,359	37,879	105,403	34,599	104,128	33,904	103,924
Pumice thousand short tons	134	102	--	--	--	--	--	--
Sand and gravel do	16,595	14,383	19,275	20,249	15,781	25,207	10,116	17,149
Silver (recoverable content of ores, etc.) thousand troy ounces	3,429	6,141	4,304	7,622	2,748	4,248	3,325	5,603
Stone thousand short tons	7,667	10,579	[4] 6,501	[4] 6,896	W	W	4,074	5,627
Tungsten ore and concentrate short tons, 60% WO_3 basis	W	W	9	23	W	W	W	W
Zinc (recoverable content of ores, etc.) short tons	6,143	1,794	1,457	446	361	116	12	4
Value of items that cannot be disclosed: Cement, clays (selected), fluorspar, gypsum, natural gas liquids, peat, phosphate rock, stone (1970–71), talc, vermiculite, and values indicated by symbol W	XX	22,189	XX	21,321	XX	37,337	XX	22,309
Total	XX	282,681	XX	313,016	XX	285,078	XX	307,676
NEBRASKA								
Clays thousand short tons	149	223	90	147	69	82	115	143

Gem stones	NA	5	NA	5	NA	10	NA	11
Lime thousand short tons	35	W	27	W	29	W	34	685
Natural gas (marketed) million cubic feet	6,980	1,200	5,991	1,024	8,496	612	8,478	619
Natural gas liquids:								
Natural gasoline thousand 42-gallon barrels	128	387	W	W	W	W	W	W
LPG do	408	788	365	858	W	W	W	W
Petroleum (crude) do	12,106	36,075	11,451	35,384	10,063	34,010	8,705	29,423
Sand and gravel thousand short tons	12,758	13,592	12,232	12,974	13,224	13,626	13,720	15,063
Stone do	4,665	9,494	4,265	7,878	4,174	7,892	4,251	7,645
Value of items that cannot be disclosed: Cement, pumice, and values indicated by symbol W	XX	16,307	XX	14,887	XX	17,347	XX	20,086
Total	XX	78,080	XX	72,657	XX	74,079	XX	78,675
NEVADA								
Antimony ore and concentrate short tons, antimony content	W	W	W	W	W	W	W	W
Barite thousand short tons	320	2,275	192	1,455	192	1,490	317	2,659
Clays do	W	W	W	W	W	W	40	183
Copper (recoverable content of ores, etc.) short tons	104,924	99,749	106,688	123,118	96,928	100,806	101,119	108,545
Gem stones	NA	100	NA	100	NA	105	NA	110
Gold (recoverable content of ores, etc.) troy ounces	456,294	18,941	480,144	17,472	374,878	15,464	419,748	24,597
Gypsum thousand short tons	521	1,550	451	1,457	695	2,372	860	2,871
Iron ore (usable) thousand long tons, gross weight	W	W	575	W	W	W	W	W
Lead (recoverable content of ores, etc.) short tons	1,420	423	364	114	111	30	(5)	(5)
Mercury 76-pound flasks	8,165	4,124	4,909	2,001	1,589	465	810	177
Perlite short tons	8,998	77	8,470	73	9,600	114	W	W
Petroleum (crude) thousand 42-gallon barrels	223	W	149	W	113	W	100	W
Pumice thousand short tons	83	188	80	191	112	232	W	W
Sand and gravel do	8,447	10,834	8,574	9,819	9,379	12,225	10,081	12,636
Silver (recoverable content of ores, etc.) thousand troy ounces	884	1,583	718	1,271	601	930	595	1,003
Stone thousand short tons	1,494	2,433	1,860	2,722	2,531	3,800	3,329	5,926
Talc and soapstone short tons	6,434	81	W	W	--	--	W	W
Tungsten ore and concentrate short tons, 60% WO₃ basis	34	69	122	306	33	88	165	W
Zinc (recoverable content of ores, etc.) short tons	941	275	127	39	71	23	--	--
Value of items that cannot be disclosed: Brucite, cement, diatomite, fluorspar, lime, lithium minerals, magnesite, molybdenum, pyrites, salt, and values indicated by symbol W	XX	r 25,594	XX	r 26,207	XX	r 26,630	XX	27,995
Total	XX	168,296	XX	186,845	XX	164,774	XX	181,702
NEW HAMPSHIRE								
Clays thousand short tons	44	40	40	32	37	34	51	70
Gem stones	W	W	W	W	NA	40	NA	42
Sand and gravel thousand short tons	6,310	5,149	6,529	4,758	8,404	6,777	6,020	6,256
Stone do	320	2,888	W	845	429	3,433	528	3,743
Value of items that cannot be disclosed: Feldspar (1969), mica scrap (1969–70), and values indicated by symbol W	XX	43	XX	3,100	--	--	--	--
Total	XX	8,120	XX	8,730	XX	10,284	XX	10,111

See footnotes at end of table.

Table 6.—Mineral production [1] in the United States, by State—Continued

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
NEW JERSEY								
Clays ......thousand short tons..	327	$1,123	262	$990	201	$864	212	$856
Gem stones	NA	10	NA	10	NA	15	NA	16
Peat ......thousand short tons..	46	551	45	557	46	526	W	W
Sand and gravel ......do....	20,325	33,977	16,782	31,571	18,511	38,279	17,679	38,020
Stone ......do....	15,162	34,084	[4]15,160	[4]40,567	[4]13,469	[4]36,057	[4]18,651	[4]53,083
Zinc (recoverable content of ores, etc.) ......short tons..	25,076	7,322	28,683	8,788	29,977	9,653	33,096	13,524
Value of items that cannot be disclosed: Lime, magnesium compounds, manganiferous residuum, greensand marl, stone dimension, 1970–72), and titanium concentrate	XX	6,122	XX	6,798	XX	[r]8,178	XX	8,261
Total	XX	83,139	XX	89,281	XX	[r]93,572	XX	118,760
NEW MEXICO								
Carbon dioxide, natural ......thousand cubic feet..	902,186	69	W	W	W	W	W	W
Clays ......thousand short tons..	70	89	67	91	[3]76	[3]114	[3]65	108
Coal (bituminous) ......do....	4,471	16,376	7,361	21,249	8,175	26,657	8,248	29,794
Copper (recoverable content of ores, etc.) ......short tons..	119,956	114,040	166,278	191,885	157,419	163,716	168,034	172,067
Feldspar ......long tons..	W	W	--	--	--	--	--	--
Gem stones	NA	60	NA	60	NA	65	NA	68
Gold (recoverable content of ores, etc.) ......troy ounces..	8,952	372	8,719	317	10,681	441	14,897	873
Gypsum ......thousand short tons..	141	526	W	W	W	W	W	W
Helium:								
Crude ......million cubic feet..	--	--	1	18	--	--	--	--
High-purity ......do....	13	260	(5)	6	W	W	--	--
Iron ore (usable) ......thousand long tons, gross weight..	W	W	W	W	W	W	W	W
Lead (recoverable content of ores, etc.) ......short tons..	2,368	705	3,550	1,109	2,971	820	3,582	1,077
Lime ......thousand short tons..	37	W	37	W	35	W	28	W
Manganese ore (5% to 35% Mn) ...short tons, gross weight..	4,855	131	4,225	W	--	--	--	--
Manganiferous ore (5% to 35% Mn) ......do....	49,146	340	46,166	W	28,490	W	27,837	W
Natural gas ......million cubic feet..	1,138,133	155,924	1,138,980	162,874	1,167,577	175,137	1,216,061	225,420
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels..	9,053	24,388	9,606	25,548	9,952	28,465	10,338	29,970
LPG ......do....	24,920	30,402	25,999	37,179	27,082	43,331	27,859	45,689
Peat ......thousand short tons..	(5)	4	(5)	7	1	W	2	46
Perlite ......do....	398	4,493	382	4,321	386	4,559	476	5,698
Petroleum (crude) ......thousand 42-gallon barrels..	129,227	404,441	128,184	410,320	118,412	402,602	110,525	376,778
Potassium salts ......thousand short tons, K_2O equivalent..	2,327	62,084	2,390	85,877	2,291	86,689	2,296	91,115
Pumice ......thousand short tons..	226	415	203	442	287	601	311	809
Salt ......do....	W	W	W	W	146	1,130	W	W
Sand and gravel ......do....	8,574	10,422	10,666	10,516	8,869	7,975	7,600	8,553
Silver (recoverable content of ores, etc.) .thousand troy ounces..	466	834	782	1,385	782	1,210	1,017	1,713
Stone ......thousand short tons..	2,826	3,286	[4]3,110	[4]4,030	[4]2,913	[4]5,337	2,768	5,499
Uranium (recoverable content U_3O_8) ......thousand pounds..	11,811	69,887	11,574	69,970	10,567	65,517	10,808	68,091
Zinc (recoverable content of ores, etc.) ......short tons..	24,308	7,098	16,601	5,086	13,959	4,495	12,735	4,521

Value of items that cannot be disclosed: Beryllium (1969), cement, fluorspar, mica scrap, molybdenum, stone (1970–71), tin (1969), vanadium and values indicated by symbol W	XX	29,150	XX	28,068	XX	27,424	XX	29,408
Total	XX	985,746	XX	1,060,858	XX	1,046,285	XX	1,097,292
NEW YORK								
Clays thousand short tons	1,623	1,783	1,707	1,897	[3]1,588	[3]1,742	[3]1,601	[3]1,919
Emery short tons	W	W	W	W	1,585	W	2,883	W
Gem stones	NA	10	NA	10	NA	15	NA	16
Gypsum thousand short tons	492	2,945	425	2,787	415	2,376	486	3,079
Lead (recoverable content of ores, etc.) short tons	1,686	502	1,280	400	877	242	1,089	327
Lime thousand short tons	1,055	10,224	W	W	W	W	W	W
Mercury 76-pound flasks	280	141	28	11	W	W	W	W
Natural gas million cubic feet	4,861	1,458	3,358	1,017	2,202	661	3,679	1,199
Peat thousand short tons	14	178	15	145	15	196	15	200
Petroleum (crude) thousand 42-gallon barrels	1,256	5,688	1,194	5,897	1,126	5,292	1,018	4,897
Salt thousand short tons	5,582	45,561	5,990	47,254	5,808	43,601	5,604	43,866
Sand and gravel do	39,806	42,518	35,587	38,839	23,221	28,828	26,722	36,952
Silver (recoverable content of ores, etc.) thousand troy ounces	32	57	24	42	18	28	25	42
Stone thousand short tons	37,561	66,889	37,616	68,118	37,778	73,418	38,188	77,825
Zinc (recoverable content of ores, etc.) short tons	58,728	17,149	58,577	17,947	63,420	20,421	60,749	21,566
Value of items that cannot be disclosed: Cement, clays (ball, 1971–72), abrasive garnet, iron ore, talc, titanium concentrate, wollastonite, and values indicated by symbol W	XX	107,482	XX	115,750	XX	[r]122,963	XX	128,565
Total	XX	302,480	XX	299,564	XX	[r]299,288	XX	320,458
NORTH CAROLINA								
Clays [3] thousand short tons	3,342	2,610	3,318	3,102	3,508	3,802	3,862	4,478
Feldspar short tons	[r]378,727	4,615	[r]386,608	5,173	[r]398,811	4,681	439,838	6,080
Gem stones	NA	20	NA	20	NA	30	NA	32
Mica:								
Scrap thousand short tons	67	1,518	64	1,457	67	1,770	91	2,942
Sheet pounds	W	3	--	--	8,705	8	--	--
Sand and gravel thousand short tons	10,562	11,437	12,772	13,277	14,240	14,690	13,485	14,615
Stone do	26,812	47,829	30,363	54,121	30,917	58,026	32,297	62,741
Talc and pyrophyllite short tons	105,728	586	92,639	544	85,289	522	89,334	594
Value of items that cannot be disclosed: Asbestos, cement, clay (kaolin), copper (1971), gold (1971), iron ore, lead (1971), lithium minerals, olivine, phosphate rock, silver (1971), tungsten (1970–71), and zinc (1971)	XX	21,843	XX	20,671	XX	[r]25,996	XX	24,896
Total	XX	90,456	XX	98,365	XX	[r]109,520	XX	116,323
NORTH DAKOTA								
Coal (lignite) thousand short tons	4,704	8,696	5,639	11,009	6,075	11,580	6,632	13,416
Gem stones	NA	1	NA	1	NA	2	NA	2
Natural gas million cubic feet	33,587	5,441	34,889	5,722	33,864	5,655	32,472	5,455
Natural gas liquids:								
Natural gasoline thousand 42-gallon barrels	508	1,846	504	1,876	W	W	W	W
LPG do	1,951	2,868	1,840	2,944	W	W	W	W

See footnotes at end of table.

Table 6.—Mineral production [1] in the United States, by State—Continued

Mineral	1969		1970		1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
NORTH DAKOTA—Continued								
Petroleum (crude)....thousand 42-gallon barrels..	22,708	$68,568	21,998	$67,107	21,658	$70,805	20,624	$67,647
Sand and gravel....thousand short tons..	7,039	7,274	8,090	6,336	8,196	6,210	6,681	5,757
Stone....do....	72	99	108	126	W	W	--	--
Value of items that cannot be disclosed: Clays, lime, peat (1970–71), pumice (1972), salt, and values indicated by symbol W..	XX	1,755	XX	1,426	XX	5,649	XX	5,809
Total....	XX	91,048	XX	96,047	XX	99,901	XX	98,086
OHIO								
Cement:								
Portland....thousand short tons..	2,889	50,071	2,209	39,997	2,897	54,338	2,968	57,958
Masonry....do....	157	3,527	121	3,116	142	3,811	161	4,684
Clays....do....	4,587	11,698	3,920	10,100	3,978	11,380	4,125	11,278
Coal (bituminous)....do....	51,242	210,082	55,351	262,390	51,481	269,601	50,967	308,819
Gem stones....	NA	8	NA	3	NA	8	NA	8
Lime....thousand short tons..	4,159	60,975	3,951	61,197	4,007	65,258	4,418	75,569
Natural gas....million cubic feet..	49,798	12,837	52,118	14,123	79,908	27,007	89,995	35,271
Peat....thousand short tons..	11	116	6	95	6	84	4	67
Petroleum (crude)....thousand 42-gallon barrels..	10,972	36,098	9,864	32,914	8,286	29,801	9,858	35,179
Salt....thousand short tons..	5,844	43,519	5,329	47,498	5,709	46,651	6,147	47,710
Sand and gravel....do....	50,029	64,552	42,069	57,506	40,797	54,044	43,506	59,982
Stone....do....	51,792	86,570	47,244	81,506	46,891	88,372	48,498	90,821
Value of items that cannot be disclosed: Abrasive stone, and gypsum....	XX	1,815	XX	1,721	XX	1,796	XX	2,462
Total....	XX	581,858	XX	612,166	XX	652,151	XX	724,748
OKLAHOMA								
Clays [2]....thousand short tons..	802	1,182	769	1,120	845	1,255	988	1,398
Coal (bituminous)....do....	1,838	10,662	2,427	15,211	2,234	15,004	2,624	19,112
Gypsum....do....	980	3,912	874	2,616	1,022	3,078	1,196	3,888
Helium:								
High-purity....million cubic feet..	221	7,717	149	5,214	123	4,305	174	6,090
Crude....do....	188	1,123	245	2,940	270	3,240	168	1,956
Lead (recoverable content of ores, etc.)....short tons..	605	180	797	249	--	--	--	--
Natural gas....million cubic feet..	1,523,715	233,128	1,594,943	248,811	1,684,260	273,945	1,806,887	294,523
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels..	14,621	38,931	14,818	39,938	14,197	40,856	14,559	42,709
LPG....do....	27,304	34,408	28,029	52,975	27,540	56,782	27,148	57,011
Petroleum (crude)....do....	224,729	701,155	223,574	712,419	213,313	725,611	207,633	709,083
Salt....thousand short tons..	9	51	18	78	W	W	W	W
Sand and gravel....do....	5,262	7,156	5,675	7,258	5,718	8,259	7,901	11,138
Stone....do....	18,799	23,650	18,177	23,701	19,449	27,125	19,448	26,574

Zinc (recoverable content of ores, etc.) short tons	2,744	801	2,650	812	W	W	W	W
Value of items that cannot be disclosed: Cement, clay (bentonite), copper, lime, silver, tripoli, and values indicated by symbol W	XX	26,758	XX	24,935	XX	30,111	XX	37,296
Total	XX	1,090,809	XX	1,188,272	XX	1,189,516	XX	1,210,728
OREGON								
Clays thousand short tons	[3]215	[3]321	[3]184	[3]180	157	255	151	238
Copper short tons	W	W	W	W	3	3	W	W
Diatomite do	85	W	500	5	70	1	W	W
Gem stones	NA	750	NA	750	NA	755	NA	798
Gold (recoverable content of ores, etc.) troy ounces	875	36	256	9	244	10	W	W
Lead short tons	(8)	(8)	(8)	(8)	--	--	--	--
Lime thousand short tons	115	2,337	96	1,777	106	1,989	96	2,129
Mercury 76-pound flasks	43	22	274	112	W	W	--	--
Nickel (content of ore and concentrate) short tons	17,056	W	15,983	W	17,086	W	16,864	W
Pumice thousand short tons	875	1,139	939	1,221	r948	r1,389	W	W
Sand and gravel do	15,470	20,491	17,582	25,978	20,230	28,707	24,489	34,981
Silver (recoverable content of ores, etc.) thousand troy ounces	5	9	4	6	4	6	2	4
Stone thousand short tons	11,662	18,897	13,439	20,948	13,794	26,708	10,915	18,330
Talc and soapstone short tons	W	W	W	W	W	W	W	W
Value of items that cannot be disclosed: Bauxite (1970), cement, clay (fire clay 1969–70), copper (1969–70), tungsten (1971–72), and values indicated by symbol W	XX	16,162	XX	17,095	XX	18,212	XX	19,991
Total	XX	60,164	XX	68,081	XX	r78,085	XX	76,516
PENNSYLVANIA								
Cement:								
Portland thousand short tons	8,440	126,941	7,691	121,100	7,850	140,460	8,214	156,008
Masonry do	482	8,504	527	8,324	559	11,247	451	12,401
Clays do	[3]2,727	[3]19,687	[3]2,665	[3]15,845	[3]2,825	[3]8,940	2,682	15,829
Coal:								
Anthracite do	10,473	100,770	9,729	105,841	8,727	108,469	7,106	85,251
Bituminous do	78,631	461,579	80,491	585,057	73,835	620,196	75,939	694,267
Copper (recoverable content of ores, etc.) short tons	3,382	3,215	2,589	2,980	3,349	3,483	2,611	2,678
Gem stones	NA	4	NA	4	NA	9	NA	9
Lime thousand short tons	2,008	28,952	1,887	29,279	1,760	30,008	1,891	33,802
Mica, scrap do	W	W	1	60	W	W	W	W
Natural gas million cubic feet	79,184	21,841	76,841	21,489	76,451	20,770	73,958	22,389
Natural gas liquids:								
Natural gasoline thousand 42-gallon barrels	22	61	19	50	W	W	W	W
LPG do	35	78	34	87	W	W	W	W
Peat thousand short tons	35	407	44	517	38	461	22	320
Petroleum (crude) thousand 42-gallon barrels	4,448	20,086	4,098	18,500	3,798	17,699	3,441	16,414
Sand and gravel thousand short tons	18,105	31,451	18,504	33,915	19,668	36,162	18,757	36,804
Stone do	66,992	117,726	66,119	120,187	64,467	118,469	67,307	124,340
Zinc (recoverable content of ores, etc.) short tons	33,085	9,646	29,554	9,055	27,488	8,835	18,344	6,512

See footnotes at end of table.

Table 8.—Mineral production[1] in the United States, by State—Continued

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
PENNSYLVANIA—Continued								
Value of items that cannot be disclosed: Clay (kaolin) (1969-71), [illegible] (1969-71), [illegible] pyrites (1969-71), [illegible] (1969), [illegible] (1969-71), tripoli, and values indicated by symbol W	XX	$25,470	XX	$24,068	XX	$25,800	XX	$24,466
Total	XX	918,868	XX	1,065,748	XX	1,149,107	XX	1,231,485
RHODE ISLAND								
Sand and gravel ... thousand short tons	2,480	3,016	2,887	2,918	2,262	3,052	2,079	3,836
Stone ... do	W	1,417	W	W	3	422	[4]329	[4]28
Value of items that cannot be disclosed: Other minerals and values indicated by symbol W	XX	1	XX	1,478	XX	825	XX	982
Total	XX	4,488	XX	4,886	XX	4,299	XX	4,291
SOUTH CAROLINA								
Clays ... thousand short tons	2,444	10,911	1,974	9,878	[5]2,049	[5]10,201	2,221	11,268
Sand and gravel ... do	5,602	8,229	5,804	7,766	6,438	9,119	7,916	12,121
Stone ... do	8,840	18,606	9,710	[4]14,784	11,047	17,852	12,482	21,819
Value of items that cannot be disclosed: Cement, feldspar, kyanite (1969), scrap mica, peat, pyrites (1969), stone, and vermiculite	XX	28,218	XX	28,987	XX	29,716	XX	37,105
Total	XX	66,864	XX	60,805	XX	66,888	XX	82,818
SOUTH DAKOTA								
Beryllium concentrate ... short tons, gross weight	46	28	W	W	W	W	W	W
Cement:								
Portland ... thousand short tons	202	5,715	W	W	W	W	W	W
Masonry ... do	7	181	W	W	W	W	W	W
Clays ... do	187	1,171	166	946	[5]150	[5]128	[5]185	[5]156
Feldspar ... short tons	[4]32,000	194	[4]19,276	114	[4]24,640	539	11,227	150
Gem stones	NA	86	NA	85	NA	40	NA	42
Gold (recoverable content of ores, etc.) ... troy ounces	598,146	24,621	578,716	21,059	518,427	21,179	407,480	23,875
Gypsum ... thousand short tons	11	46	15	61	21	88	24	48
Lead (recoverable content of ores, etc.) ... short tons	1	(6)	3	1	--	--	--	--
Mica (scrap) ... thousand short tons	(6)	20	(6)	84	W	W	W	W
Petroleum (crude) ... thousand 42-gallon barrels	158	362	160	374	238	604	219	574
Sand and gravel ... thousand short tons	11,158	10,807	16,556	16,656	16,727	18,892	12,748	14,798
Silver (recoverable content of ores, etc.) ... thousand troy ounces	124	228	120	212	107	165	100	168
Stone ... thousand short tons	2,092	10,839	1,979	13,375	3,199	8,874	2,665	10,864

Value of items that cannot be disclosed: Columbium-tantalum concentrate (1969), lime, lithium minerals (1969), tin (1969), uranium, vanadium (1970, 1972) and values indicated by symbol W	XX	683	XX	8,709	XX	12,984	XX	14,535
Total	XX	54,921	XX	61,576	XX	62,988	XX	65,200
TENNESSEE								
Barite……thousand short tons	16	295	19	236	21	342	W	W
Cement:								
Portland……do	1,722	29,403	1,669	29,332	1,713	33,732	1,695	37,176
Masonry……do	186	3,587	136	2,749	159	3,649	176	4,104
Clays [3]……do	1,719	7,064	1,401	7,123	1,537	6,595	1,718	7,719
Coal (bituminous)……do	8,062	30,682	8,237	40,372	9,271	59,368	11,260	81,336
Copper (recoverable content of ores, etc.)……short tons	15,353	14,596	15,585	17,928	13,916	14,473	11,310	11,581
Gold (recoverable content of ores, etc.)……troy ounces	126	5	124	5	192	8	176	10
Natural gas……million cubic feet	57	11	64	13	89	20	25	8
Petroleum (crude)……thousand 42-gallon barrels	32	W	309	W	398	W	198	W
Phosphate rock……thousand short tons	W	W	3,073	15,005	2,571	12,151	2,154	10,732
Sand and gravel……do	6,175	9,709	6,715	10,639	8,018	11,845	10,839	15,328
Silver (recoverable content of ores, etc.) thousand troy ounces	79	141	95	168	131	208	83	141
Stone……thousand short tons	33,265	46,192	35,374	50,018	32,869	48,665	35,942	55,512
Zinc (recoverable content of ores, etc.)……short tons	124,532	36,368	118,260	36,233	119,295	38,418	101,722	36,111
Value of items that cannot be disclosed: Clay (fuller's earth), lime, pyrites, and values indicated by symbol W	XX	27,402	XX	10,099	XX	10,197	XX	10,006
Total	XX	205,450	XX	220,465	XX	239,662	XX	269,814
TEXAS								
Cement:								
Portland……thousand short tons	6,715	117,989	6,386	122,960	7,198	140,206	7,818	171,642
Masonry……do	155	3,878	141	3,769	169	4,514	217	5,812
Clays……do	4,407	8,664	4,148	9,587	4,615	10,432	5,175	11,554
Coal (lignite)……do	W	W	W	W	W	W	4,045	W
Gem stones	NA	150	NA	150	NA	155	NA	168
Gypsum……thousand short tons	1,314	4,398	1,220	4,252	1,308	4,806	1,542	5,284
Helium:								
Crude……million cubic feet	1,190	13,058	1,157	13,262	1,208	14,496	1,026	12,312
High-purity……do	141	4,917	82	2,862	50	1,750	--	--
Lime……thousand short tons	1,633	22,107	1,678	24,427	1,612	24,583	1,631	22,181
Natural gas……million cubic feet	7,853,199	1,075,888	8,357,716	1,208,511	8,550,705	1,376,664	8,657,840	1,419,886
Natural gas liquids:								
Natural gasoline and cycle products thousand 42-gallon barrels	96,628	289,042	97,511	284,871	96,286	299,981	92,437	294,163
LPG……do	194,599	237,411	204,177	334,850	210,435	380,887	226,624	428,819
Petroleum (crude)……do	1,151,775	3,696,328	1,249,607	4,104,005	1,222,926	4,261,775	1,301,685	4,536,077
Perlite……short tons	--	--	--	--	--	--	2,391	24
Pumice……thousand short tons	W	W	W	W	4	4	W	W
Salt……do	9,261	43,012	10,184	45,000	9,217	40,838	9,744	36,544
Sand and gravel……do	29,972	39,756	31,438	46,362	32,788	51,814	35,151	56,328
Stone……do	46,638	64,986	45,557	64,422	41,168	[4]62,144	49,314	[4]66,578
Sulfur (Frasch process)……thousand long tons	2,552	68,360	2,801	62,290	[5]3,092	W	3,847	W

See footnotes at end of table.

Table 6.—Mineral production[1] in the United States, by State—Continued

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
TEXAS—Continued								
Talc and soapstone ... short tons	163,812	$668	171,420	$878	198,330	$1,024	221,022	$1,262
Value of items that cannot be disclosed: Native asphalt, bromine (1969), fluorspar (1972), graphite, iron ore, magnesium chloride (for metal), magnesium compounds (except for metal), mercury, sodium sulfate, uranium, vermiculite (1969), and values indicated by symbol W	XX	79,868	XX	74,541	XX	[r]182,210	XX	148,427
Total	XX	5,769,970	XX	6,401,999	XX	[r]6,808,288	XX	7,211,551
UTAH								
Carbon dioxide, natural ... thousand cubic feet	64,839	5	60,754	4	55,178	4	61,103	4
Clays ... thousand short tons	179	1,286	189	1,237	198	1,064	[3]266	[3]790
Coal (bituminous) ... do	4,657	29,396	4,733	34,472	4,626	34,082	4,802	42,868
Copper (recoverable content of ores, etc.) ... short tons	296,699	282,066	295,738	341,282	268,451	278,989	259,507	265,735
Fluorspar ... do	6,667	207	19,214	595	10,947	341	2,977	84
Gem stones	NA	85	NA	85	NA	90	NA	95
Gold (recoverable content of ores, etc.) ... troy ounces	433,385	17,990	408,029	14,848	368,996	15,221	362,418	21,237
Iron ore (usable) ... thousand long tons, gross weight	1,921	12,552	1,990	13,337	1,681	11,886	1,788	W
Lead (recoverable content of ores, etc.) ... short tons	41,332	12,818	45,877	14,175	38,270	10,562	20,706	6,224
Lime ... thousand short tons	191	3,947	186	3,756	172	3,569	171	4,216
Manganiferous ore (5% to 35% Mn) ... short tons	--	--	700	W	112	W	--	--
Natural gas ... million cubic feet	46,733	7,197	42,781	6,460	42,418	7,064	39,474	6,711
Natural gas liquids:								
Natural gasoline and cycle products ... thousand 42-gallon barrels	W	W	W	W	W	W	458	1,406
LPG ... do	W	W	W	W	W	W	1,742	2,787
Petroleum (crude) ... do	23,295	65,320	23,370	65,608	23,630	71,886	26,570	80,773
Pumice ... thousand short tons	10	21	W	18	6	10	14	29
Salt ... do	481	4,439	450	4,192	614	5,218	660	4,955
Sand and gravel ... do	19,151	16,042	12,010	10,439	10,505	10,190	14,619	17,071
Silver (recoverable content of ores, etc.) ... thousand troy ounces	5,954	10,661	6,080	10,678	5,294	8,185	4,300	7,245
Stone ... thousand short tons	2,582	4,434	1,650	4,320	2,556	5,335	3,384	6,005
Tungsten concentrates ... short tons, 60% WO₃ basis	3	6	W	W	W	W	W	W
Uranium (recoverable content U_3O_8) ... thousand pounds	1,140	6,824	1,835	10,023	1,445	8,959	1,496	9,425
Vanadium (recoverable in ore and concentrate) ... short tons	W	W	257	W	226	W	188	W
Zinc (recoverable content of ores, etc.) ... do	34,902	10,191	34,688	10,628	25,701	8,276	21,853	7,758
Value of items that cannot be disclosed: Asphalt (gilsonite), beryl (1970–72), cement, certain clays (1972), gypsum, magnesium chloride (1972), magnesium compounds, molybdenum, perlite (1969–70), phosphate rock, potassium salts, sodium sulfate (1970–72), and values indicated by symbol W	XX	57,507	XX	55,899	XX	49,754	XX	57,391
Total	XX	542,489	XX	602,551	XX	525,700	XX	542,809

VERMONT								
Lime……thousand short tons..	2	25	--	--	--	--	--	--
Peat……do….	(5)	4	(5)	6	W	W	(5)	1
Sand and gravel……do….	3,336	3,028	4,046	4,122	3,761	3,518	3,302	3,214
Stone……do….	2,151	19,810	1,514	19,088	[r]2,496	[r]27,940	2,300	26,170
Talc……short tons..	W	W	W	W	W	W	180,239	1,326
Value of items that cannot be disclosed: Asbestos, clays, gem stones, and values indicated by symbol W……	XX	4,892	XX	4,627	XX	4,681	XX	4,157
Total……	XX	27,759	XX	27,843	XX	[r]36,069	XX	34,868
VIRGINIA								
Clays……thousand short tons..	1,677	1,504	1,633	1,672	1,710	1,800	1,634	1,733
Coal (bituminous)……do….	35,555	192,802	35,016	246,181	30,628	254,870	34,028	344,061
Gem stones……	NA	7	NA	7	NA	12	NA	13
Lead (recoverable content of ores, etc.)……short tons..	3,358	1,000	3,356	1,048	3,386	984	3,441	1,084
Lime……thousand short tons..	1,072	13,658	1,046	14,090	759	11,049	758	11,739
Natural gas……million cubic feet..	2,846	845	2,805	864	2,619	822	2,787	892
Petroleum (crude)……thousand 42-gallon barrels..	1	W	1	W	1	W	(5)	(5)
Sand and gravel……thousand short tons..	12,140	15,954	11,126	15,229	12,796	20,201	14,065	21,626
Soapstone……short tons..	4,600	12	3,760	9	3,704	8	W	W
Stone……thousand short tons..	33,461	58,713	35,415	60,477	34,648	63,482	39,986	74,080
Zinc (recoverable content of ores, etc.)……short tons..	18,704	5,462	18,063	5,534	16,829	5,419	16,789	5,960
Value of items that cannot be disclosed: Aplite, cement, feldspar, gypsum, iron ore, kyanite, salt, titanium concentrate, and values indicated by symbol W……	XX	27,575	XX	29,210	XX	26,564	XX	28,523
Total……	XX	317,527	XX	374,321	XX	385,161	XX	489,791
WASHINGTON								
Cement:								
Portland……thousand short tons..	1,195	22,724	1,221	24,832	1,149	23,785	1,239	26,848
Masonry……do….	8	204	6	158	5	145	6	170
Clays [3]……do….	230	434	240	486	255	549	264	584
Coal (bituminous)……do….	58	480	37	470	1,184	7,614	2,635	17,424
Copper (recoverable content of ores, etc.)……short tons..	18	17	9	11	W	W	W	W
Gem stones……	NA	150	NA	150	NA	155	NA	168
Gypsum……thousand short tons..	W	W	--	--	W	W	5	18
Lead (recoverable content of ores, etc.)……short tons..	8,649	2,577	6,784	2,119	5,117	1,429	2,567	772
Peat……thousand short tons..	33	184	17	71	17	72	18	89
Sand and gravel……do….	34,245	31,046	25,089	27,902	22,702	26,658	23,065	26,069
Silver (recoverable content of ores, etc.)..thousand troy ounces..	W	W	W	W	W	W	221	372
Stone……thousand short tons..	15,742	21,069	18,701	19,100	12,496	20,489	14,712	[4]23,764
Talc and soapstone……short tons..	4,228	W	W	W	W	W	W	W
Zinc (recoverable content of ores, etc.)……do….	9,738	2,843	11,956	8,663	5,782	[r]1,862	6,488	2,301
Value of items that cannot be disclosed: Abrasives (1971), bauxite (1970), certain clays, diatomite, gold, lime, olivine, pumice, uranium (1970–72), and values indicated by symbol W……	XX	6,948	XX	12,010	XX	[r]11,898	XX	11,287
Total……	XX	88,626	XX	90,922	XX	94,601	XX	109,806

See footnotes at end of table.

Table 6.—Mineral production [1] in the United States, by State—Continued

Mineral	1969 Quantity	1969 Value (thousands)	1970 Quantity	1970 Value (thousands)	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
WEST VIRGINIA								
Clays [3] ....thousand short tons	247	$348	191	$238	282	$336	274	$408
Coal (bituminous) ....do	141,011	807,811	144,072	1,142,245	118,258	1,128,282	123,743	1,275,813
Gem stones	NA	W	NA	W	NA	2	NA	2
Lime ....thousand short tons	269	3,648	262	3,757	197	3,078	W	W
Natural gas ....million cubic feet	231,759	62,575	242,452	61,583	234,027	60,618	214,951	64,485
Petroleum (crude) ....thousand 42-gallon barrels	3,104	11,888	3,124	11,871	2,969	11,609	2,677	12,047
Salt ....thousand short tons	1,309	4,978	1,190	5,171	1,174	4,778	1,232	5,963
Sand and gravel ....do	5,021	11,475	4,396	11,473	7,107	16,756	5,765	15,031
Stone [4] ....do	9,031	15,801	9,740	16,722	9,880	18,066	11,649	21,293
Value of items that cannot be disclosed: Cement, fire clay, natural gas liquids, stone, and values indicated by symbol W	XX	28,715	XX	32,804	XX	30,445	XX	35,595
Total	XX	947,239	XX	1,285,864	XX	1,273,960	XX	1,430,682
WISCONSIN								
Clays ....thousand short tons	12	24	8	14	4	8	4	7
Gem stones	NA	W	NA	W	NA	W	NA	1
Iron ore (usable) ....thousand long tons, gross weight	86	W	806	W	824	W	887	W
Lead (recoverable content of ores, etc.) ....short tons	1,102	328	761	238	752	207	757	228
Lime ....thousand short tons	244	4,080	247	4,508	246	4,570	263	5,009
Peat ....do	2	155	2	W	2	153	2	179
Sand and gravel ....do	42,815	35,414	41,108	35,107	38,561	32,748	36,430	31,824
Stone ....do	18,954	27,571	17,577	25,167	15,568	25,105	19,394	29,681
Zinc (recoverable content of ores, etc.) ....short tons	22,901	6,687	20,684	6,822	10,645	3,428	6,878	2,440
Value of items that cannot be disclosed: Abrasive stones, cement, and value indicated by symbol W	XX	5,533	XX	16,819	XX	17,817	XX	20,484
Total	XX	79,792	XX	87,670	XX	84,036	XX	89,853
WYOMING								
Clays ....thousand short tons	1,992	18,970	1,950	18,829	1,798	17,378	1,878	18,509
Coal (bituminous) ....do	4,602	15,443	7,222	24,423	8,052	27,335	10,928	40,898
Gem stones	NA	129	NA	180	NA	185	NA	142
Gypsum ....thousand short tons	W	W	216	868	232	918	W	W
Iron ore (usable) ....thousand long tons, gross weight	2,048	20,751	W	W	1,808	W	2,030	W
Lime ....thousand short tons	27	W	22	W	27	W	W	W
Natural gas ....million cubic feet	303,517	44,617	338,520	49,762	330,105	58,156	375,059	60,760
Natural gas liquids:								
Natural gasoline ....thousand 42-gallon barrels	2,523	7,051	2,597	7,085	2,514	7,415	3,015	8,951
LPG ....do	4,428	7,085	4,556	7,472	5,474	10,127	7,691	15,586
Petroleum (crude) ....do	154,945	433,846	160,345	469,811	148,114	459,079	140,011	482,071
Sand and gravel ....thousand short tons	7,568	7,288	9,447	9,298	9,820	8,750	9,098	14,916
Stone ....do	1,584	3,012	1,266	2,758	2,894	4,789	3,549	5,768
Uranium (recoverable content U_3O_8) ....thousand pounds	6,716	40,318	6,346	38,768	6,986	43,811	8,544	53,827

Value of items that cannot be disclosed: Cement, copper (1969), feldspar (1970-72), gold (1969), phosphate rock, pumice, (1969, 1972), sodium carbonate, sodium sulfate (1969-70), and values indicated by symbol W	XX	48,933	XX	76,329	XX	80,544	XX	95,365
Total	XX	647,443	XX	705,533	XX	717,937	XX	746,743

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[r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data. XX Not applicable.
[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).
[2] Excludes certain cement, included with "Value of items that cannot be disclosed."
[3] Excludes certain clays, included with "Value of items that cannot be disclosed."
[4] Excludes certain stones, included with "Value of items that cannot be disclosed."
[5] Less than ½ unit.
[6] Excludes salt in brine, included with "Value of items that cannot be disclosed."

Table 7.—Mineral production[1] in the Canal Zone and islands administered by the United States

Area and mineral	1969		1970		1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
American Samoa:								
Pumice..thousand short tons..	2	$5	2	$6	10	$35	--	--
Sand and gravel........do....	7	7	26	25	--	--	--	--
Stone................do....	54	108	49	69	33	30	49	414
Total..................	XX	120	XX	100	XX	65	XX	414
Canal Zone:								
Sand and gravel thousand short tons..	60	97	60	97	--	--	--	--
Stone................do....	74	231	85	265	--	--	--	--
Total..................	XX	328	XX	362	XX	--	XX	--
Guam: Stone.thousand short tons..	654	1,399	636	1,289	718	1,705	831	1,983
Virgin Islands: Stone.......do....	411	1,682	514	2,226	r 543	W	726	2,255
Wake: Stone..............do....	9	45	4	18	r 3	16	--	--

r Revised. W Withheld to avoid disclosing individual company confidential data. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 8.—Mineral production[1] in the Commonwealth of Puerto Rico

Mineral	1969		1970		1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement..thousand short tons..	1,681	$27,920	1,778	$29,515	2,001	$38,413	1,946	$31,756
Clays................do....	438	454	429	486	342	358	361	382
Lime.................do....	41	1,505	41	W	44	W	42	1,776
Salt.................do....	32	395	32	395	29	570	29	580
Sand and gravel........do....	9,432	23,296	11,506	28,001	r 12,998	r 34,980	7,478	21,237
Stone................do....	6,985	13,550	7,296	13,947	12,130	29,847	13,504	32,793
Total..............	XX	67,120	XX	[2] 72,344	XX	r [2] 104,168	XX	88,524

r Revised. W Withheld to avoid disclosing individual company confidential data. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Total does not include value of items withheld.

Table 9.—U.S. exports of principal minerals and products

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Metals:				
Aluminum:				
Ingots, slabs, crude……short tons..	112,295	$58,040	108,319	$51,879
Scrap……do….	30,675	9,995	66,039	21,072
Plates, sheets, bars, etc……do….	[r] 141,138	[r] 111,827	144,987	115,279
Castings and forgings……do….	3,561	8,245	4,467	11,681
Aluminum sulfate……do….	16,840	568	4,968	181
Other aluminum compounds……do….	[r] 1,142,980	[r] 96,885	942,084	83,490
Antimony: Metals and alloys crude……do….	1,023	761	121	85
Bauxite, including bauxite concentrates thousand long tons..	34	1,529	29	1,299
Beryllium……pounds..	41,114	1,051	95,492	839
Bismuth: Metals and alloys……do….	71,187	199	264,276	493
Cadmium……thousand pounds..	66	172	1,017	2,363
Chrome:				
Ore and concentrates:				
Exports……thousand short tons..	35	2,094	20	824
Reexports……do….	145	6,081	57	1,946
Ferrochrome……do….	9	3,620	13	4,342
Cobalt……thousand pounds..	1,212	2,108	2,597	5,005
Columbium metals, alloys and other forms.do….	21	588	29	453
Copper:				
Ore, concentrate, composition metal and unrefined (copper content)……short tons..	36,824	30,672	35,562	26,548
Refined copper and semimanufactures.do….	215,705	267,303	215,591	278,059
Other copper manufactures……do….	7,746	9,145	6,299	7,400
Copper sulfate or blue vitriol……do….	2,815	2,078	2,646	1,767
Copper base alloys……do….	[r] 97,975	[r] 106,840	90,377	105,586
Ferroalloys:				
Ferrosilicon……do….	25,506	5,603	7,367	2,196
Ferrophosphorous……do….	35,111	1,419	1,179	111
Gold:				
Ore and base bullion……troy ounces..	577,502	23,470	265,788	14,531
Bullion, refined……do….	761,302	27,779	1,206,386	48,522
Iron ore……thousand long tons..	3,061	38,147	2,095	26,776
Iron and steel:				
Pig iron……short tons..	34,164	2,352	15,018	931
Iron and steel products (major):				
Semimanufactures……do….	[r] 2,505,864	[r] 405,538	2,309,583	400,820
Manufactured steel mill products.do….	[r] 1,020,206	538,994	1,236,897	605,600
Iron and steel scrap: Ferrous scrap, including rerolling materials…thousand short tons..	6,653	222,222	7,683	252,617
Lead:				
Pigs, bars, anodes……short tons..	5,925	3,889	8,376	4,500
Scrap……do….	[r] 17,091	[r] 2,268	35,233	4,264
Magnesium: Metal and alloys and semimanufactured forms, n.e.c……do….	24,311	15,692	17,556	11,702
Manganese:				
Ore and concentrate……do….	55,413	2,683	25,108	3,137
Ferromanganese……do….	4,526	1,205	6,842	1,512
Mercury:				
Exports……76-pound flasks..	7,232	2,789	400	129
Reexports……do….	--	--	563	121
Molybdenum:				
Ore and concentrates (molybdenum content) thousand pounds..	46,284	79,111	45,362	73,039
Metals and alloys, crude and scrap…do….	222	227	89	199
Wire……do….	140	1,212	173	1,551
Semifabricated forms, n.e.c……do….	623	1,195	181	987
Powder……do….	41	170	50	192
Ferromolybdenum……do….	1,355	1,978	509	1,163
Nickel:				
Alloys and scrap (including Monel metal), ingots, bars, sheets, etc……short tons..	18,923	48,503	16,694	42,677
Catalysts……do….	3,740	10,018	2,573	6,794
Nickel-chrome electric resistance wire.do….	643	3,269	553	2,638
Semifabricated forms, n.e.c……do….	2,837	12,780	1,851	11,659
Platinum:				
Ore, concentrate, metal and alloys in ingots, bars, sheets, anodes, and other forms, including scrap……troy ounces..	320,842	29,432	417,037	44,256
Palladium, rhodium, iridium, osmiridium, ruthenium, and osmium (metal and alloys including scrap)……do….	83,768	4,021	121,949	7,511
Platinum-group manufactures, except jewelry	NA	4,769	NA	4,255

See footnotes at end of table.

Table 9.—U.S. exports of principal minerals and products—Continued

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Metals—Continued				
Rare-earth elements:				
Cerium ore, metal, alloys and lighter flints pounds	60,044	$164	202,206	$610
Silver:				
Ore, concentrates, waste and sweepings thousand troy ounces	3,728	6,164	2,964	4,899
Bullion, refined do	8,496	13,634	26,693	44,361
Tantalum:				
Ore, metal, and other forms thousand pounds	242	2,611	162	2,308
Powder do	85	2,519	171	3,572
Tin:				
Ingots, pigs, bars, etc.:				
Exports long tons	1,821	6,648	857	2,915
Reexports do	441	1,620	277	1,055
Tin scrap and other tin-bearing material except tinplate scrap do	2,605	1,780	3,548	3,392
Titanium:				
Ore and concentrate short tons	1,760	299	1,802	394
Sponge (including iodide titanium and scrap) do	1,711	1,139	3,510	2,165
Intermediate mill shapes and mill products, n.e.c do	430	4,788	562	6,265
Dioxide and pigments do	26,759	9,378	10,334	4,882
Tungsten: Ore and concentrates:				
Exports thousand pounds	2,006	7,323	95	211
Reexports do	1	1	--	--
Vanadium ore and concentrate, pentoxide, etc. (vanadium content) do	520	1,834	351	756
Zinc:				
Slabs, pigs, or blocks short tons	13,346	2,337	4,324	714
Sheets, plates, strips, or other forms, n.e.c do	1,686	1,486	2,419	2,138
Scrap (zinc content) do	2,000	504	1,446	431
Semifabricated forms, n.e.c do	6,042	2,709	6,052	3,076
Zirconium:				
Ore and concentrate do	9,429	802	17,360	940
Metals and alloys and other forms pounds	1,125,242	13,054	1,314,219	11,509
Nonmetals:				
Abrasives:				
Dust and powder of precious or semiprecious stones, including diamond dust and powder thousand carats	7,506	18,726	8,263	21,986
Crushing bort do	20	94	55	305
Industrial diamond do	415	1,831	484	1,889
Diamond grinding wheels do	526	2,932	554	3,073
Other natural and artificial, metallic abrasives and products	NA	37,102	NA	36,956
Asbestos, unmanufactured:				
Exports short tons	52,202	7,571	51,792	7,621
Reexports do	1,476	292	6,832	1,430
Boron: Boric acid, borates, crude and refined do	202,496	24,411	189,778	22,530
Cement do	r 109,566	r 3,463	100,889	3,712
Clays:				
Kaolin or china clay do	673,083	26,125	667,519	26,332
Fire clay do	161,934	3,566	124,307	2,905
Other clays do	1,137,723	35,638	1,053,892	36,979
Fluorspar do	12,491	525	2,764	184
Graphite do	5,733	680	7,289	888
Gypsum:				
Crude, crushed or calcined thousand short tons	r 49	2,318	51	2,582
Manufactures, n.e.c	NA	1,896	NA	2,694
Kyanite and allied minerals short tons	31,554	2,097	73,911	3,737
Lime do	65,862	1,971	37,659	1,242
Mica sheet, waste and scrap and ground pounds	14,383,388	1,209	13,957,313	1,842
Mica, manufactured do	798,956	2,559	1,001,639	2,910
Mineral-earth pigments: Iron oxide, natural and manufactured short tons	r 10,545	r 5,812	8,194	5,087
Nitrogen compounds (major) thousand short tons	3,126	141,381	4,004	222,441
Phosphate rock do	12,687	94,816	13,992	107,438

See footnotes at end of table.

Table 9.—U.S. exports of principal minerals and products—Continued

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Nonmetals—Continued				
Phosphatic fertilizers (superphosphates) thousand short tons	r 748	r $30,391	967	$52,465
Pigments and compounds (lead and zinc):				
Lead pigments short tons	1,955	833	1,867	818
Zinc pigments do	7,229	2,864	7,567	2,764
Potash:				
Fertilizer do	1,032,948	35,323	1,353,471	45,858
Chemical do	r 33,177	r 6,765	31,435	6,890
Quartz, natural, quartzite, cryolite and chiolite do	431	54	677	130
Salt:				
Crude and refined thousand short tons	670	4,182	869	5,544
Shipments to noncontiguous Territories do	19	1,898	21	2,303
Sodium and sodium compounds:				
Sodium sulfate do	66	1,825	29	926
Sodium carbonate do	437	15,400	480	18,914
Stone:				
Dolomite, block do	87	1,639	77	1,025
Limestone, crushed, ground, broken do	r 1,823	r 3,752	1,730	3,802
Marble and other building and monumental thousand cubic feet	NA	905	NA	755
Stone, crushed, ground, broken thousand short tons	585	3,871	1,085	4,298
Manufactures of stone	NA	1,322	NA	1,227
Sulfur:				
Crude thousand long tons	1,532	27,844	1,847	32,409
Crushed, ground, flowers of do	4	1,019	5	1,278
Talc, crude and ground short tons	135,881	4,844	171,007	5,791
Fuels:				
Carbon black thousand pounds	163,246	20,425	111,328	14,924
Coal:				
Anthracite thousand short tons	671	10,104	743	10,922
Bituminous do	56,633	891,484	55,960	971,282
Briquets do	72	4,335	75	4,285
Coke do	1,509	44,819	1,232	30,720
Natural gas thousand cubic feet	84,196,444	38,430	89,499,088	42,176
Petroleum:				
Crude thousand barrels	503	1,563	192	565
Gasoline do	1,783	15,259	493	4,896
Jet do	211	898	258	3,055
Naphtha do	1,593	16,401	1,438	34,242
Kerosine do	172	1,356	84	778
Distillate oil do	2,869	12,328	755	3,055
Residual oil do	13,162	40,991	11,576	34,349
Lubricating oil do	15,218	183,032	12,149	169,424
Asphalt do	304	3,449	304	3,572
Liquefied petroleum gases do	9,379	29,235	11,475	46,581
Wax do	1,638	36,017	1,105	25,840
Coke do	26,823	106,594	30,667	111,950
Petrochemical feedstocks do	5,243	27,555	4,605	23,414
Miscellaneous do	1,006	20,132	1,042	17,073
Total	XX	r 4,357,478	XX	4,648,087

r Revised. NA Not available. XX Not applicable.

Table 10.—U.S. imports for consumption of principal minerals and products

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Metals:				
Aluminum:				
Metal...short tons..	554,208	$257,473	661,042	$304,536
Scrap...do....	62,840	[r]22,004	52,801	17,747
Plates, sheets, bars, etc...do....	70,944	45,702	78,951	50,209
Aluminum oxide (alumina)..do....	[r]2,410,191	[r]141,904	2,849,995	173,413
Antimony:				
Ore (antimony content)...do....	9,619	8,787	17,212	9,437
Needle or liquated...do....	32	47	78	75
Metal...do....	1,688	1,914	2,302	2,092
Oxide...do....	2,791	4,317	5,062	5,766
Arsenic: White (As_2O_3 content)..do....	[r]17,306	2,187	13,618	1,956
Bauxite: Crude...thousand long tons..	12,326	153,639	11,428	151,012
Beryllium ore...short tons..	4,026	1,475	3,345	1,101
Bismuth...pounds..	848,708	4,050	1,562,934	5,235
Boron carbide...do....	18,298	56	11,622	61
Cadmium:				
Metal...thousand pounds..	3,499	6,264	2,422	4,886
Flue dust (cadmium content).do....	1,112	1,118	741	685
Calcium:				
Metal...pounds..	48,391	30	248,080	184
Chloride...short tons..	13,019	544	6,128	225
Chromate:				
Ore and concentrates (Cr_2O_3 content) thousand short tons..	590	[r]31,878	501	27,627
Ferrochrome...do....	54	22,697	90	34,588
Metal...do....	2	2,966	2	3,791
Cobalt:				
Metal...thousand pounds..	10,381	[r]22,377	13,082	30,650
Oxide (gross weight)...do....	726	1,426	1,134	2,330
Salts and compounds (gross weight) do....	40	27	82	44
Columbium ore...do....	3,054	2,222	3,227	1,927
Copper: (copper content)				
Ore and concentrates...short tons..	5,547	4,091	80,740	81,055
Regulus, black, coarse...do....	119	220	1,453	1,134
Unrefined, black, blister...do....	153,625	144,395	77,162	72,514
Refined in ingots, etc...do....	163,988	[r]165,300	175,703	172,772
Old and scrap...do....	7,459	6,679	10,787	9,766
Ferroalloys: Ferrosilicon (silicon content) do....	[r]12,683	[r]5,750	23,154	8,815
Gold:				
Ore and base bullion..troy ounces..	191,470	7,264	265,453	14,023
Bullion...do....	7,009,241	276,683	5,860,749	343,666
Iron ore...thousand long tons..	40,124	450,644	35,761	415,934
Iron and steel:				
Pig iron...short tons..	306,320	16,964	636,932	33,518
Iron and steel products (major):				
Iron products...do....	37,519	13,964	41,428	18,158
Steel products...do....	[r]18,706,757	[r]2,788,825	18,117,041	2,965,950
Scrap...do....	263,192	10,713	295,000	14,304
Tinplate...do....	20,239	546	17,040	437
Lead:				
Ore, flue dust, matte (lead content) do....	88,184	19,362	51,642	10,554
Base bullion (lead content)..do....	41	16	895	238
Pigs and bars (lead content).do....	192,570	48,021	245,598	64,096
Reclaimed scrap, etc. (lead content) do....	2,518	579	1,753	450
Sheet, pipe and shot...do....	237	86	142	52
Magnesium:				
Metallic and scrap...do....	3,442	1,633	4,298	1,990
Alloys (magnesium content).do....	99	286	168	464
Sheets, tubing, ribbons, wire and other forms (magnesium content) do....	130	397	13	103
Manganese:				
Ore (35% or more manganese) (manganese content)...do....	[r]938,122	42,184	792,695	34,315
Ferromanganese (manganese content)...do....	189,260	32,392	274,717	49,846
Mercury:				
Compounds...pounds..	1,220	9	9,028	45
Metal...76-pound flasks..	28,449	8,165	28,834	6,211

See footnotes at end of table.

Table 10.—U.S. imports for consumption of principal minerals and products—Continued

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Metals—Continued				
Minor metals: Selenium and salts pounds..	409,264	$4,134	448,964	$4,362
Nickel:				
Pigs, ingots, shot, cathodes short tons..	100,531	259,931	125,364	300,825
Scrap....................do....	1,336	1,896	2,306	3,517
Oxide....................do....	5,769	11,604	5,988	12,038
Platinum group:				
Unwrought:				
Grains and nuggets (platinum) troy ounces..	34,958	3,170	58,284	7,254
Sponge (platinum)......do....	r329,967	r36,882	350,143	42,622
Sweepings, waste and scrap do....	75,031	7,477	75,210	7,600
Iridium................do....	14,298	1,908	24,827	4,038
Palladium..............do....	r220,888	r7,919	289,055	12,929
Rhodium................do....	33,764	5,980	47,378	8,785
Ruthenium..............do....	28,063	1,222	61,191	2,602
Other platinum-group metals do....	15,037	2,067	103,734	12,148
Semimanufactured:				
Platinum...............do....	105,806	11,475	207,960	22,869
Palladium..............do....	442,465	15,198	613,174	22,488
Rhodium................do....	898	169	3,426	543
Other platinum-group metals do....	1,575	207	6,920	473
Radium: Radioactive substitutes........	NA	5,671	NA	4,444
Rare-earth elements: Ferrocerium and other cerium alloys..........pounds..	16,190	82	27,867	94
Silver:				
Ore and base bullion thousand troy ounces..	33,452	45,003	33,768	49,979
Bullion..................do....	22,388	33,979	25,680	41,579
Tantalum ore.......thousand pounds..	1,180	3,332	1,229	2,663
Tin:				
Ore (tin content)........long tons..	3,060	10,564	4,216	12,475
Blocks, pigs, grains, etc.....do....	46,940	164,403	52,451	195,421
Dross, skimmings, scrap, residues and tin alloys, n.s.p.f.......do....	4,125	1,385	1,304	2,140
Tin foil, powder, flitters, etc........	NA	r4,472	NA	6,501
Titanium:				
Ilmenite[1]..............short tons..	378,049	10,459	395,218	14,237
Rutile...................do....	215,109	23,155	195,068	21,788
Metal...................pounds..	6,594,448	6,355	8,769,356	8,041
Ferrotitanium...............do....	173,057	154	181,826	76
Compounds and mixtures....do....	86,230,153	16,125	173,597,069	33,908
Tungsten: (tungsten content)				
Ore and concentrates thousand pounds..	418	1,033	5,739	12,139
Metal....................do....	17	117	61	342
Other alloys...............do....	129	1,804	644	2,902
Zinc:				
Ore (zinc content)......short tons..	467,368	62,678	174,063	24,275
Blocks, pigs, and slabs.......do....	r324,255	r93,628	516,643	176,707
Sheets...................do....	509	287	485	310
Old, dross, and skimmings...do....	1,967	287	2,882	2,170
Dust.....................do....	8,184	2,949	9,197	3,822
Manufactures..................	NA	1,347	NA	2,040
Zirconium: Ore, including zirconium sand do....	96,387	3,656	67,537	3,291
Nonmetals:				
Abrasives: Diamond (industrial) thousand carats..	12,910	46,023	15,184	52,619
Asbestos.................short tons..	681,367	80,090	735,515	87,732
Barite:				
Crude and ground..........do....	484,762	4,490	624,634	5,658
Witherite.................do....	511	42	1,311	169
Chemicals.................do....	7,800	1,299	23,592	3,959
Cement.......................do....	r8,088	44,348	4,894	71,530
Clays:				
Raw......................do....	58,965	1,289	62,576	1,095
Manufactured..............do....	5,084	212	4,138	214
Cryolite.......................do....	23,127	5,056	25,642	3,451

See footnotes at end of table.

Table 10.—U.S. imports for consumption of principal minerals and products—Continued

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Nonmetals—Continued				
Feldspar: Crude — long tons	120	$19	167	$23
Fluorspar — short tons	1,072,405	34,580	1,181,583	47,851
Gem stones:				
Diamond — thousand carats	4,667	463,242	5,506	626,679
Emeralds — do	351	7,731	578	22,176
Other	NA	55,010	NA	67,281
Graphite — short tons	[r]57,756	2,727	64,185	3,847
Gypsum:				
Crude, ground, calcined — thousand short tons	6,096	13,552	7,720	18,494
Manufactures	NA	2,780	NA	3,548
Iodine, crude — thousand pounds	7,275	11,510	6,207	10,184
Kyanite — short tons	1,343	65	124	6
Lime:				
Hydrated — do	39,807	618	37,468	724
Other — do	202,477	2,690	210,995	3,224
Magnesium compounds:				
Crude magnesite — short tons	7	(2)	--	--
Lump, ground, caustic calcined magnesia — do	11,518	786	10,376	675
Refractory magnesia, dead-burned fused magnesite, dead-burned dolomite — do	129,025	10,014	133,784	9,695
Compounds — do	49,731	1,257	25,301	1,111
Mica:				
Uncut sheet and punch — thousand pounds	1,355	1,171	1,494	1,162
Scrap — do	7,284	171	2,641	62
Manufactures — do	4,464	2,476	5,644	3,183
Mineral-earth pigments: Iron oxide pigments:				
Natural — short tons	1,794	171	2,777	236
Synthetic — do	28,236	5,592	34,274	7,602
Ocher, crude and refined — do	--	--	98	6
Siennas, crude and refined — do	1,427	125	1,272	196
Umber, crude and refined — do	4,681	228	8,284	412
Vandyke brown — do	358	89	621	77
Nitrogen compounds (major), including urea — thousand short tons	2,573	118,281	2,683	125,037
Phosphate, crude — do	84	2,478	57	1,544
Phosphatic fertilizers — do	92	6,972	70	3,184
Pigments and salts:				
Lead pigments and compounds — short tons	[r]27,898	[r]7,647	26,550	9,244
Zinc pigments and compounds — do	[r]20,913	4,187	25,984	6,891
Potash — do	4,687,379	118,481	4,996,415	128,548
Pumice:				
Crude or unmanufactured — do	8,833	109	9,094	149
Wholly or partly manufactured — do	390,900	975	589,758	1,351
Manufactures, n.s.p.f	NA	18	NA	24
Quartz crystal (Brazillian pebble) — pounds	752,001	368	462,740	331
Salt — thousand short tons	3,855	14,429	3,463	11,979
Sand and gravel:				
Glass sand — do	48	243	49	201
Other sand and gravel — do	667	984	712	1,178
Sodium sulfate — do	[r]268	4,667	299	5,358
Stone and whiting	NA	33,643	NA	43,472
Strontium: Mineral — short tons	45,505	1,115	30,677	830
Sulfur and pyrites:				
Sulfur ore and other forms n.e.s. — thousand long tons	[r]1,299	25,419	1,138	16,288
Pyrites — do	285	962	125	472
Talc: Unmanufactured — short tons	17,382	745	29,085	1,669
Fuels:				
Carbon black:				
Acetylene — pounds	6,125,541	1,405	6,022,118	1,581
Gas black and carbon black — do	386,246	41	1,149,099	176
Coal:				
Bituminous, slack, culm and lignite — short tons	111,036	1,772	47,098	691

See footnotes at end of table.

Table 10.—U.S. imports for consumption of principal minerals and products—Continued

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Fuels—Continued				
Coal—Continued				
Briquets............short tons....	4,145	$63	5,849	$96
Coke.......................do....	173,914	5,038	185,023	4,649
Natural gas, ethane, methane, and mixtures thereof....thousand cubic feet..	1,115,381,461	312,067	1,307,679,012	402,979
Peat:				
Fertilizer grade..........short tons..	293,810	14,988	307,233	16,951
Poultry and stable grade.....do....	2,473	154	3,258	222
Petroleum:				
Crude petroleum.thousand barrels..	670,972	1,687,279	896,991	2,369,176
Distillate....................do....	36,108	103,227	107,905	254,529
Residual.....................do....	r 498,711	r 1,109,596	479,929	1,170,172
Unfinished oils..............do....	4,801	12,292	1,812	5,324
Gasoline......................do....	353	1,684	1,744	8,730
Jet fuel......................do....	r 57,254	r 182,912	65,674	223,084
Motor fuels, n.e.s............do....	1,127	3,538	171	669
Kerosine......................do....	211	779	270	1,299
Lubricants....................do....	14	593	702	987
Wax...........................do....	96	505	73	1,342
Naphtha.......................do....	69,066	169,273	86,279	213,857
Liquefied petroleum gases....do....	26,247	57,208	32,485	73,340
Asphalt.......................do....	r 7,428	16,242	9,653	23,852
Miscellaneous.................do....	4,241	15,088	10,573	36,810
Total..........................	**XX**	**r 10,481,161**	**XX**	**12,459,466**

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r Revised. NA Not available. XX Not applicable.

[1] Includes titanium slag averaging about 70% TiO_2. For detail see Titanium Chapter, table 9.

[2] Less than ½ unit.

Table 11.—Comparison of world and United States production of principal metals and minerals

(Thousand short tons unless otherwise specified)

Mineral	1971 [r]			1972 [p]		
	World production [1]	U.S. production	U.S.% of world production	World production [1]	U.S. production	U.S.% of world production
MINERAL FUELS						
Carbon black___thousand pounds__	6,276,475	3,017,135	48	6,581,354	3,201,109	49
Coal:						
Bituminous [2]________________	2,241,737	545,790	24	2,272,827	584,387	26
Lignite______________________	881,479	6,402	1	887,065	10,999	1
Pennsylvania anthracite_______	198,653	8,727	4	195,933	7,106	4
Coke (excluding breeze):						
Gashouse [3]__________________	24,688	--	--	22,972	--	--
Oven and beehive_____________	372,979	57,436	15	374,593	60,507	16
Natural gas (marketable) million cubic feet__	40,252,299	22,493,012	56	42,481,435	22,531,698	53
Peat__________________________	89,610	605	1	89,338	577	1
Petroleum (crude) thousand barrels__	17,674,726	3,453,914	20	18,583,783	3,455,368	19
NONMETALS						
Asbestos______________________	3,951	131	3	4,083	132	3
Barite________________________	4,231	825	20	4,260	906	21
Cement________________________	667,614	[4] 81,223	12	702,666	[4] 83,697	12
China clay____________________	14,245	[5] 4,885	34	15,224	[5] 5,318	35
Corundum______________________	8	--	--	9	--	--
Diamond________thousand carats__	41,102	--	--	43,155	--	--
Diatomite_____________________	1,712	535	31	1,727	576	33
Feldspar______________________	2,749	743	27	2,685	732	28
Fluorspar_____________________	5,244	272	5	5,150	250	5
Graphite______________________	432	W	NA	394	W	NA
Gypsum________________________	58,552	10,418	18	63,545	12,328	19
Lime (sold or used by producers)___	106,456	[4] 19,685	18	109,447	[4] 20,332	19
Magnesite_____________________	9,975	W	NA	9,764	W	NA
Mica (including scrap) thousand pounds__	375,554	254,185	68	440,016	320,014	73
Nitrogen, agricultural [6]___________	36,305	[4] 8,996	25	38,698	[4] 9,169	24
Phosphate rock________________	96,040	38,886	40	103,866	40,831	39
Potash (K_2O equivalent)___________	21,818	2,588	12	22,465	2,659	12
Pumice [7]______________________	17,417	3,401	20	17,660	3,819	22
Pyrites_______thousand long tons__	21,457	808	4	20,022	741	3
Salt__________________________	158,933	[4] 44,106	28	162,560	[4] 45,050	28
Strontium_____________________	121	--	--	119	--	--
Sulfur, elemental thousand long tons__	22,722	8,620	38	25,795	9,218	36
Talc, pyrophyllite, and soapstone__	5,207	1,037	20	5,252	1,107	21
Vermiculite [7]__________________	459	301	66	512	337	66
METALS, MINE BASIS						
Antimony (content of ore and concentrate)___________short tons__	70,891	1,025	1	75,035	489	1
Arsenic, white________________	55	W	NA	50	W	NA
Bauxite_______thousand long tons__	62,506	[8] 1,988	3	64,844	[8] 1,812	3
Beryllium concentrate__short tons__	5,844	W	NA	4,740	W	NA
Bismuth________thousand pounds__	8,442	W	NA	8,794	W	NA
Cadmium__________________do____	34,241	[9] 7,930	23	36,599	[9] 8,290	23
Chromite______________________	6,908	--	--	6,840	--	--
Cobalt (contained)_____________	24	W	NA	26	W	NA
Columbium-tantalum concentrates [7] thousand pounds__	24,014	--	--	34,958	--	--
Copper (content of ore and concentrate)_______________________	6,653	[10] 1,522	23	7,314	[10] 1,665	23
Gold_______thousand troy ounces__	46,491	1,495	3	44,712	1,450	3
Iron ore______thousand long tons__	766,758	[11] 80,762	11	756,488	[11] 75,434	10
Lead (content of ore and concentrate)_______________________	3,772	579	15	3,849	619	16
Manganese ore (35% or more Mn)_	23,170	([12])	([12])	22,832	1	([12])
Mercury_thousand 76-pound flasks__	299	18	6	279	7	3
Molybdenum (content of ore and concentrate)__thousand pounds__	170,840	109,592	64	175,250	112,132	64
Nickel (content of ore and concentrate)_______________________	700	17	2	698	17	2
Platinum group (Pt., Pd., etc.) thousand troy ounces__	4,084	18	([12])	4,613	17	([12])
Silver____________________do____	298,783	41,564	14	301,291	37,233	13
Tin (content of ore and concentrate) long tons__	232,232	W	NA	239,602	W	NA

See footnotes at end of table.

Table 11.—Comparison of world and United States production of principal metals and minerals—Continued

(Thousand short tons unless otherwise specified)

Mineral	1971 [r]			1972 [p]		
	World production [1]	U.S. production	U.S.% of world production	World production [1]	U.S. production	U.S.% of world production
METALS, MINE BASIS—Continued						
Titanium concentrates:						
Ilmenite [7]	3,705	714	19	3,586	726	20
Rutile [7]	424	--	--	357	--	--
Tungsten concentrate (contained tungsten) thousand pounds	80,744	6,900	9	84,793	8,150	10
Vanadium (content of ore and concentrate) short tons	18,571	5,252	28	19,949	4,887	24
Zinc (content of ore and concentrate)	6,155	491	8	6,158	478	8
METALS, SMELTER BASIS						
Aluminum	11,375	3,925	35	12,103	4,122	34
Copper	6,739	[13] 1,500	22	7,300	[13] 1,690	23
Iron, pig	473,914	81,382	17	498,754	88,864	18
Lead	3,501	[14] 650	19	3,725	[14] 696	19
Magnesium	256	123	48	256	121	47
Selenium [7] thousand pounds	2,527	657	26	2,642	769	29
Steel ingots and castings	639,865	[15] 120,443	19	691,551	[15] 133,241	19
Tellurium [7] thousand pounds	340	164	48	422	257	61
Tin long tons	231,901	[16] 4,000	2	236,185	[16] 4,000	2
Uranium oxide (U_3O_8) [7] short tons	23,921	12,273	51	27,277	13,667	50
Zinc	5,175	766	15	5,615	633	11

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data.

[1] Total is not strictly comparable with previous years because it does not represent total world production. Confidential U.S. data are excluded. These data include reported figures and reasonable estimates. In some instances where data were not available, no reasonable estimate could be made and none has been included except for gold, silver and pyrites.

[2] Includes small quantities of lignite for People's Republic of China, and Pakistan, and anthracite for Colombia.

[3] Includes low- and medium-temperature and gashouse coke.

[4] Includes Puerto Rico.

[5] Kaolin sold or used by producers.

[6] Year ended June 30 of year stated (United Nations).

[7] World total exclusive of the U.S.S.R.

[8] Dry bauxite equivalent of crude ore.

[9] Includes secondary.

[10] Recoverable.

[11] Includes byproduct ore.

[12] Less than ½ unit.

[13] Smelter output from domestic and foreign ores, exclusive of scrap. Production from domestic ores only, exclusive of scrap, was as follows: 1970—1,605,265; 1971—1,470,815; 1972—1,649,130.

[14] Lead refined from domestic and foreign ores, excludes lead refined from imported base bullion.

[15] Data from American Iron and Steel Institute. Excludes production of castings by companies that do not produce steel ingots.

[16] Includes tin content of alloys made directly from ores.

The Mineral Industry of Alabama

By H. L. Riley [1] and W. Everett Smith [2]

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Alabama for collecting information on all minerals except fuels.

Bituminous coal production increased from 17,945,000 tons in 1971 to 20,814,000 tons in 1972. Both underground and surface production increased. Coke production declined slightly. Reported shipments of portland cement from Alabama plants increased 3%.

Total mineral production value increased from $291,492,000 in 1971 to $371,241,000 in 1972. Coal, cement, petroleum, and stone accounted for 90% of the total value, with coal alone accounting for 54%. Alabama ranked second in the Nation in the production of bauxite and scrap and flake mica, and fourth in kaolin.

The value of exports from the Mobile Customs District increased 5.1% to $547.7 million; imports were valued at $300.6 million, or 11.2% more than in 1971.

Table 1.—Mineral production in Alabama [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Cement: [2]				
Masonry ....thousand short tons..	349	$8,657	407	$11,221
Portland ....do....	2,284	42,281	2,360	48,577
Clays ....do....	2,915	6,913	2,850	7,512
Coal (bituminous) ....do....	17,945	146,180	20,814	200,430
Iron ore (usable) ....thousand long tons, gross weight..	415	2,773	327	1,912
Lime ....thousand short tons..	761	11,454	739	11,751
Natural gas ....million cubic feet..	355	54	3,644	1,282
Petroleum (crude) ....thousand 42-gallon barrels..	7,332	23,496	9,934	30,466
Sand and gravel ....thousand short tons..	6,674	7,513	6,352	8,530
Stone ....do....	17,773	34,418	18,485	42,027
Value of items that cannot be disclosed:				
Asphalt (native), bauxite, cement (slag), clay (bentonite), mica (scrap), natural gas liquids, salt, stone (dimension), and talc	XX	7,758	XX	7,533
Total	XX	291,492	XX	371,241
Total 1967 constant dollars	XX	247,856	XX	[p] 308,835

[p] Preliminary. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes slag cement; included with "Value of items that cannot be disclosed."

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[1] Mining engineer, Division of Fossil Fuels—Mineral Supply.

[2] Chief, Economic Geology Division, Geological Survey of Alabama, Tuscaloosa, Ala.

Table 2.—Value of mineral production in Alabama, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Autauga	$178	W	Sand and gravel.
Baldwin	W	W	Clays, petroleum.
Barbour	2,488	W	Bauxite, clays, sand and gravel.
Bibb	5,732	$6,494	Coal, stone, clays, sand and gravel.
Blount	3,107	2,359	Coal, cement, stone.
Calhoun	2,891	3,594	Clays, stone.
Chilton	W	W	Sand and gravel.
Choctaw	--	4,551	Petroleum.
Clarke	W	W	Sand and gravel, petroleum.
Cleburne	47	--	
Coffee	56	40	Sand and gravel.
Colbert	W	2,656	Stone, asphalt.
Covington	--	W	Stone.
Crenshaw	W	W	Iron ore, sand and gravel.
Cullman	1,453	3,441	Coal.
Dale	W	35	Sand and gravel.
Dallas	W	W	Sand and gravel, clays.
De Kalb	W	W	Stone, coal.
Elmore	W	W	Stone, sand and gravel, clays.
Escambia	W	6,498	Petroleum, natural gas, sand and gravel, clays.
Etowah	W	W	Stone, coal.
Fayette	210	--	
Franklin	3,546	3,578	Stone, iron ore, sand and gravel, clays.
Geneva	W	W	Sand and gravel.
Hale	W	W	Do.
Henry	W	W	Clays, bauxite.
Houston	W	W	Sand and gravel.
Jackson	W	W	Stone, coal.
Jefferson	104,846	133,209	Coal, cement, stone, clays, iron ore, sand and gravel.
Lamar	--	12	Petroleum.
Lee	W	491	Stone.
Limestone	82	28	Do.
Lowndes	W	W	Clays, sand and gravel.
Macon	313	1,056	Sand and gravel.
Madison	W	W	Stone, clays.
Marengo	W	W	Cement, stone.
Marion	W	W	Coal, clays, sand and gravel.
Marshall	W	W	Stone, clays.
Mobile	13,475	36,325	Petroleum, cement, stone, sand and gravel, natural gas liquids, clays.
Monroe	W	W	Petroleum, natural gas, sand and gravel.
Montgomery	W	W	Sand and gravel, clays.
Morgan	W	W	Stone.
Randolph	W	W	Mica.
Russell	W	W	Sand and gravel, clays.
St. Clair	7,522	8,864	Cement, stone, sand and gravel, clays.
Shelby	33,378	31,129	Lime, cement, stone, coal, clays.
Sumter	W	W	Clays, sand and gravel.
Talladega	8,786	14,277	Stone, talc.
Tuscaloosa	W	16,927	Coal, sand and gravel, iron ore.
Walker	30,706	59,698	Coal, clays.
Washington	W	W	Stone, salt, sand and gravel.
Winston	1,799	2,070	Coal.
Undistributed[2]	70,878	33,913	
Total[3]	291,492	371,241	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Bullock, Butler, Chambers, Cherokee, Clay, Conecuh, Coosa, Greene, Lauderdale, Lawrence, Perry, Pickens, Pike, Tallapoosa, and Wilcox.

[2] Includes value of petroleum which cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Alabama business activity

	1971	1972 [p]	Change, percent
Monthly average employment:			
Total nonagricultural thousands	1,021.9	1,065.2	+4.2
Manufacturing do	319.4	327.8	+2.6
Nonmanufacturing do	702.5	737.4	+5.0
Personal income:			
Total millions	$10,765	$11,699	+8.7
Per capita	$3,087	$3,333	+8.0
Construction activity:			
Highway construction contracts awarded millions	$54.5	[e] $100.0	+83.5
New housing units authorized	24,924	29,007	+16.4
Value of nonresidential construction millions	$165.4	$180.7	+9.3
Farm marketing, cash receipts do	$864.0	$987.9	+14.3
Mineral production value do	$291.5	$371.2	+27.3
Utility consumption:			
Total consumption of electrical energy billion kilowatt-hours	34.6	38.0	+9.8
Consumption for industrial purposes do	19.1	21.0	+9.9
Foreign trade, Mobile Customs District: [1]			
Value of exports millions	$382.9	$574.7	+50.1
Value of imports do	$270.3	$300.6	+11.2

[e] Estimate. [p] Preliminary.

[1] Includes period from October 1970 through September 1971 and from October 1971 through October 1972.

Sources: Alabama Business, Center for Business and Economic Research, University of Alabama; Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Roads and Streets; U.S. Bureau of Mines; and Highlights of U.S. Exports and Import Trade.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	4,764	240	1,148	9,114	6	212	23.92	NA
Metal	529	340	180	1,477	--	8	5.41	213
Nonmetal	756	255	193	1,580	1	33	21.51	4,051
Sand and gravel	550	246	135	1,222	1	16	13.91	5,725
Stone	2,319	283	656	5,448	--	51	9.36	1,439
Total	8,918	259	[1] 2,306	18,841	8	320	17.41	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	515	337	173	1,432	--	11	7.68	240
Nonmetal	480	260	125	1,061	--	23	21.68	483
Sand and gravel	280	226	63	589	--	14	23.78	650
Stone	1,695	298	505	4,132	2	43	10.89	3,342
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data do not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

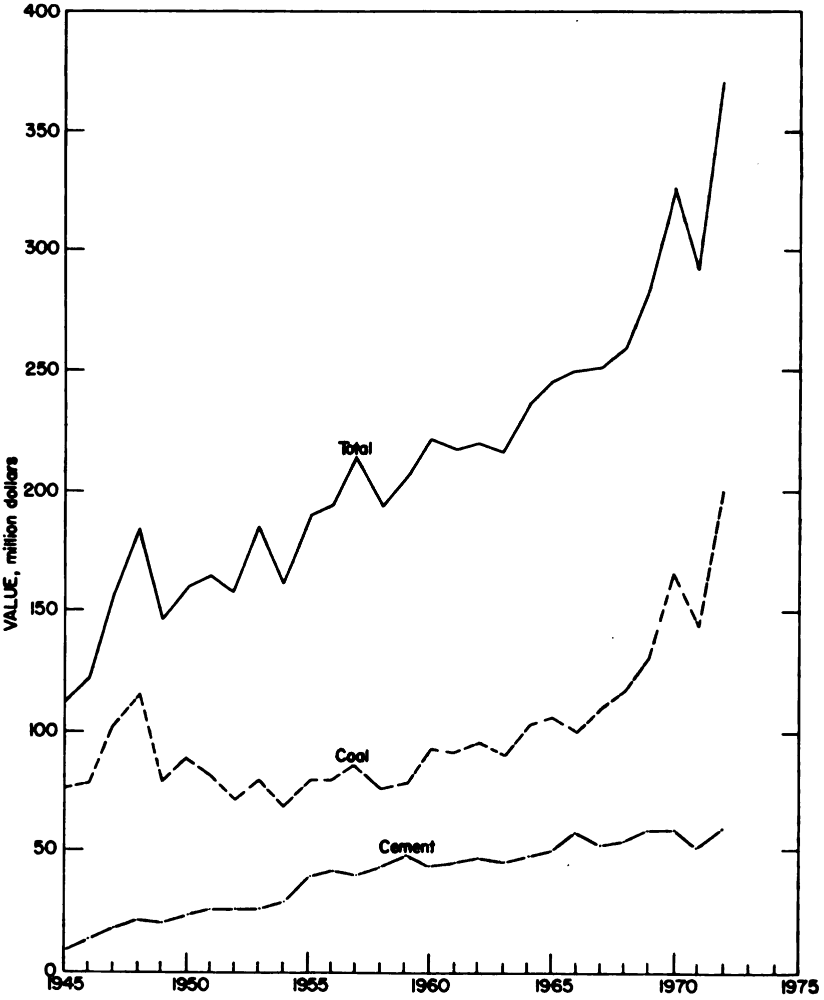

Figure 1.—Value of coal, cement, and total value of mineral production in Alabama.

Trends and Developments.—Four contracts totaling more than $4.6 million have been signed for major equipment for the planned Alabama State Docks coal bulk handling facility. Scheduled for completion in 1974, the facility will have an annual capacity of 10 million tons. Loading capacity has been designed at 4,000 tons per hour.

The Jim Walter Corp. announced that its subsidiary, U.S. Pipe & Foundary Co., had acquired 75 million tons of metallurgical coal reserves. These reserves, in the Warrior coalfield, are adjacent to the U.S. Pipe &

Foundry Co. coal reserves near Adger in Jefferson County. Three 1,300-foot shafts are planned to open a new mine near Adger with an annual production of 1.5 million tons of low-sulfur coal.

Plans to open a new mine near Hueytown in Jefferson County were announced by United States Steel Corp. The new mine, named the Oak Grove, will operate in the Mary Lee coalbed, which is about 1,100 feet below the surface in this area. The mine will be equipped with continuous miners and a slope conveyor belt to transport the coal to the surface. Planned production is 3 million tons per year. A 5½-mile belt conveyor will carry the coal to a preparation plant at the Concord mine.

Consolidation Coal Co. has been exploring for strippable lignite deposits in southern Alabama.

Southern Natural Gas Co. at Birmingham announced plans to invest $21 million in new gas facilities in southwest Alabama to bring gas produced in the Big Escambia Creek field to western Alabama. The facilities will include a 100-mile pipeline, a plant in Escambia County to convert liquids into gas, and a compressor station near Selma, Dallas County.

Humble Oil and Refining Co.'s facilities for treating gas from the Flomaton gasfield, near the Alabama-Florida border, came into operation. The $7 million plant will remove hydrogen sulfide and carbon dioxide from the gas. The plant has a daily processing capacity of 35 million cubic feet of sour gas to produce 13 million cubic feet of usable gas, 2,600 barrels of condensate, and 136 tons of sulfur.

The Southern Co. has announced plans to construct a pilot plant to refine coal by the solvent method.

Glassrock Products Inc. announced construction of a plant to manufacture magnesium oxide at Barton, Colbert County. Magnesium oxide is used as an insulator for electrical heating elements.

The Alabama Water Improvement Commission adopted water quality standards covering the following classifications: Public Water Supply, Swimming and Other Whole Body Water-Contact Sports, Shellfish Harvesting, Fish and Wildlife, and Agricultural and Industrial Water Supply.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Mineral fuels accounted for 63% of the total value of mineral production, with the bituminous coal value alone accounting for 54% of the total.

Coal (Bituminous).—Coal production in 1972 was 20,814,000 tons, a 16% increase from the 17,945,000 tons produced in 1971. The 1972 value was $200,430,000 compared with $146,180,000 in 1971, an increase of 37%.

Surface mines accounted for 64% of the total coal tonnage produced, compared with 62% in 1971. Surface mine production totaled 13,226,000 tons in 1972, compared with 11,194,000 tons in 1971. In 1972, 101 strip mines were in operation, compared with 95 in 1971. A total of 150 dragline and power shovels were in use at surface mines. The number of shovels and dipper capacities were as follows: 81 shovels up to 5 cubic yards; 17 shovels, 6 to 15 cubic yards; 10 shovels, 16 to 50 cubic yards; and 1 shovel in excess of 50 cubic yards. The number of draglines and the bucket capacities were as follows: 11 draglines up to 5 cubic yards; 17 draglines, 6 to 15 cubic yards; 12 draglines, 16 to 50 cubic yards; and 1 dragline in excess of 50 cubic yards. Six carryall scrapers, 181 bulldozers, and 145 front-end loaders were used. Eleven horizontal and 60 vertical power drills were reported. One auger was reported in use.

Twenty-four underground mines operated in 1972, compared with 16 in 1971. Production from underground mines was 7,588,000 tons in 1972. Equipment used in the underground mines included 64 cutting machines which undercut 6,671,000 tons, 5 continuous miners which produced 891,000 tons, 49 mobile drills, 68 mobile loaders which loaded 6,636,000 tons, 37 rotary drills, 7 percussion drills, 115 trolley-type locomotives, and 1,971 rail-type mine cars.

Leading coal producers with more than 1 million tons per year were United States Steel Corp., Alabama By-Products Corp., Southern Electric Generating Co., and Arch Minerals Corp.

Table 5 represents bituminous coal production and value by county.

Coke.—Production of oven coke totaled 5,354,854 tons, compared with 5,363,000 tons in 1971. Seven plants produced coke in Alabama; five in Jefferson County, and one each in Etowah and Tuscaloosa Counties.

Natural Gas.—The marketed production of natural gas in 1972 was 3,644 million cubic feet, compared with 355 million cubic feet in 1971. The value increased from $54,000 to $1,282,000; the average well head value was 35 cents per thousand cubic feet. The increased production, in part, came from the sour gas plant of Humble Oil and Refining Co. near Flomaton.

Petroleum.—Crude petroleum production increased 26.8% in 1972 to 9,934,000 barrels from 7,832,000 barrels in 1971. The value increased 29.7% in 1972 from $23.5 million to $30.5 million. Petroleum production by county is shown in table 6. Production in the major field, the Citronelle, in Mobile County, decreased slightly.

NONMETALS

Nonmetals accounted for 36% of the State's total mineral production value in 1972, compared with 39% in 1971.

Cement.—Portland cement was produced at seven plants in the State: three plants in Jefferson County, and one plant each in Shelby, Mobile, St. Clair, and Marengo Counties. In Jefferson County, two plants produced both masonry and portland cement. Only masonry cement was produced at a plant in Blount County and a plant

Table 5.—Alabama: Bituminous coal production, by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total	
Bibb	--	1	--	1	--	898	--	898	$5,712
Blount	--	4	--	4	--	260	--	260	2,156
Cullman	--	5	--	5	--	554	--	554	3,441
De Kalb	--	1	--	1	--	20	--	20	W
Etowah	--	1	--	1	--	16	--	16	118
Jackson	--	2	--	2	--	1,279	--	1,279	W
Jefferson	16	34	1	51	5,222	4,167	49	9,438	101,518
Marion	4	5	--	9	39	348	--	387	3,089
Shelby	1	2	--	3	2	99	--	101	523
Tuscaloosa	--	8	--	8	--	2,208	--	2,208	16,406
Walker	3	35	--	38	2,326	3,138	--	5,464	58,774
Winston	--	3	--	3	--	188	--	188	2,070
Undistributed[1]	--	--	--	--	--	--	--	--	6,678
Total[2]	24	101	1	126	7,588	13,177	49	20,814	200,430

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 6.—Alabama: Oil and gas well drilling completions, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Baldwin	--	--	--	--	--	4	4	68,097
Choctaw	6	--	6	2	--	16	30	347,671
Clarke	1	--	--	--	--	12	13	151,474
Conecuh	--	--	--	--	--	5	5	59,664
Covington	--	--	--	--	--	3	3	37,555
Cullman	--	--	--	--	--	1	1	8,270
Escambia	3	1	2	--	1	9	16	240,898
Fayette	--	--	--	--	4	3	7	21,068
Greene	--	--	--	--	--	1	1	2,465
Lamar	--	1	6	--	--	4	11	24,674
Madison	--	--	--	--	--	3	3	3,125
Marengo	--	--	--	--	--	1	1	7,774
Monroe	--	--	1	--	--	4	5	53,130
Pickens	--	--	--	--	--	5	5	36,887
Washington	1	1	1	--	1	5	9	127,483
Wilcox	--	--	--	--	--	1	1	3,500
Total	11	3	16	2	6	77	115	1,193,735

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 7.—Alabama: Crude oil production, by county
(Thousand 42-gallon barrels and thousand dollars)

County	Production 1971	Production 1972	Principal fields in 1972, in order of production
Baldwin	16	(1)	South Carlton.
Choctaw	922	1,484	Womack Hill, Choctaw Ridge, Turkey Creek, Toxey, Barrytown, Gilbertown.
Clarke and Baldwin	131	168	South Carlton.
Escambia	220	1,681	Little Escambia Creek, Flomaton, Pollard.
Lamar	7	4	East Detroit.
Mobile	6,455	6,447	Citronelle.
Monroe	43	150	Vocation, Uriah.
Washington	38	--	
Total	7,832	9,934	
Value	$23,496	$30,466	

[1] Baldwin combined with Clark County.
Source: State Oil and Gas Board of Alabama.

in Jefferson County. Portland cement shipments in 1972 totaled 2,360,000 short tons compared with 2,284,000 short tons in 1971, an increase of 3%. Portland cement shipments in 1972 were valued at $48,577,000, compared with $42,281,000 in 1971, an increase of 15%. Production of portland cement in 1972 was 2,419,000 short tons. Stocks of portland cement at 1972 yearend were 151,646 short tons, compared with 117,500 short tons in 1971.

Shipments of masonry cement during 1972 were 406,743 short tons valued at $11.2 million. In 1971, shipments were 349,057 short tons valued at $8,657,000. Production of masonry cement in 1972 was 411,000 short tons, compared with 349,000 short tons in 1971, an increase of 18%.

Portland and masonry cement used in the State totaled 1,252,000 short tons and 110,000 short tons, respectively.

The end uses for portland cement were as follows: ready-mix concrete, 63%; concrete products, 14%; building materials, 9%; and other uses 14%.

Raw materials used in making portland cement included 3,713,034 tons of limestone, oyster shells, and cement rock, 327,910 tons of clay and shale, 177,656 tons of sand, and 185,735 tons of slag, gypsum, and iron-bearing materials.

A small quantity of slag cement was produced by Southern Cement.

Table 8 shows portland cement salient statistics, and table 9 provides similar data for masonry cement.

Clays.—Common clay and shale was mined by 20 companies at 28 pits in 16 counties. Leading counties in terms of production were Jefferson, Walker, Sumter, and Shelby. Production was 2,388,062 tons valued at $3,462,479. Major uses were in the manufacture of building brick, other heavy clay products, lightweight aggregates, and cement.

Table 8.—Alabama: Portland cement statistics

	1971	1972
Number of active plants	7	7
Production __short tons__	2,207,851	2,419,344
Shipments from mills:		
Quantity _____do____	2,284,039	2,359,553
Value	$42,280,774	$48,577,895
Stocks at mills, Dec. 31 short tons__	117,454	151,646

Table 9.—Alabama: Masonry cement statistics

	1971	1972
Number of active plants	8	7
Production __short tons__	348,594	411,078
Shipments from mills:		
Quantity _____do____	349,057	406,743
Value	$8,657,368	$11,221,127
Stocks at mills, Dec. 31 short tons__	19,670	26,889

Fire clay was mined by seven companies at seven open pits in Calhoun, Henry, Barbour, and Walker Counties. Production was 350,094 tons valued at $2,862,973.

Alabama ranked fourth among the States in the production of kaolin. Three companies mined 112,152 tons of kaolin valued at $1,186,466 from four open pits in three countries. Producing counties were Henry, Barbour, and Marion. Kaolin was used in refractories, as a catalyst in oil refineries, and as a mineral filler.

Lime.—Martin Marietta Cement, Allied Products Co., Longview Lime Co., Cheney Lime & Cement Co., and Alabaster Lime

Co. produced lime in Shelby County for paper and pulp, steel furnaces, water purification, and other uses. Output decreased 3% to 739,000 tons and was 4% below the 1968 record. The lime was consumed in Alabama, Florida, Georgia, Tennessee, Mississippi, and other destinations. Total lime consumption in Alabama was 385,452 short tons. End uses for lime and values are shown in table 10.

Mica.—Scrap mica was produced by one company which operated two mines in Randolph County; production increased 14%. Among the States, Alabama ranked second in the Nation in production of scrap mica.

Mullite.—Harbison-Walker Refractories Co. manufactured synthetic mullite at Eufalla in Henry County.

Salt.—Salt was produced from well brines by one company for use in chemical manufacture. Production in 1972 increased 5% and value increased 12%.

Sand and Gravel.—Sand and gravel was produced at 46 operations in 27 counties. Production was 6,352,000 tons valued at $8,530,000. Nearly all the sand and gravel was used for building and paving. Table 11 gives sand and gravel production and value by county and table 12 presents data on major end uses.

Table 10.—Alabama: Lime sold or used by producers, by use

Use	1971 Quantity (short tons)	1971 Value (thousands)	1972 Quantity (short tons)	1972 Value (thousands)
Paper and pulp	215,566	$2,437	231,034	$3,586
Basic oxygen furnaces	110,592	1,562	119,969	1,862
Water purification	87,081	1,152	95,251	1,478
Electric furnaces	28,544	413	48,814	758
Sewage	45,187	668	38,838	603
Miscellaneous chemicals	43,910	691	34,740	539
Aluminum and bauxite	11,898	170	10,544	164
Sugar refining	--	--	3,678	57
Other [1]	218,392	4,361	156,613	2,704
Total	761,170	11,454	739,481	11,751

[1] Includes construction, magnesia, open hearth furnaces, petrochemicals, other metallurgy, alkalies, manganese, insecticides, agriculture, fertilizer (1972), ore concentration (1972), tanning, chrome, calcium carbide, food (1972), silica brick (1972), paint, sulfur removal (1972), petroleum refining, coke (1971), wire drawing (1972), glass (1972), and oil well drilling (1971).

Table 11.—Alabama: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971 Number of mines	1971 Quantity	1971 Value	1972 Number of mines	1972 Quantity	1972 Value
Autauga	1	266	178	2	W	W
Calhoun	1	3	2	--	--	--
Cleburne	1	19	47	--	--	--
Coffee	2	50	56	1	50	40
Crenshaw	1	W	W	1	9	25
Dale	3	W	W	1	48	35
Fayette	2	284	210	--	--	--
Jefferson	--	--	--	1	2	3
Macon	3	153	313	5	W	1,056
Marshall	1	80	160	--	--	--
Monroe	1	W	W	1	42	44
Montgomery	5	1,521	1,073	3	374	996
Tuscaloosa	2	W	W	3	226	470
Washington	--	--	--	1	74	75
Undistributed [1]	[r] 35	4,300	5,476	27	5,029	5,788
Total [2]	58	6,674	7,513	46	6,352	8,530

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Barbour, Bibb, Chilton, Clarke, Dallas, Elmore, Escambia, Franklin, Geneva, Hale, Houston, Lowndes, Marion (1972), Mobile, Russell, St. Clair (1972), and Sumter, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 12.—Alabama: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,969	2,213	1,796	1,937
Fill	W	W	98	94
Paving	553	666	814	1,299
Other uses [1]	1,163	851	625	1,028
Total [2]	3,686	3,730	3,334	4,358
Gravel:				
Building	1,427	2,193	992	1,727
Fill	--	--	W	W
Paving	1,158	1,243	1,796	2,220
Miscellaneous	384	299	W	147
Other uses [3]	--	--	230	78
Total [2]	2,969	3,736	3,018	4,171
Government-and-contractor operations:				
Sand: Building	8	21	--	--
Gravel: Building	11	27	--	--
Total sand and gravel [2]	6,674	7,513	6,352	8,530

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."

[1] Includes engine, molding, chemicals, railroad ballast, and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes fill, miscellaneous and other gravel.

Table 13.—Alabama: Crushed limestone and dolomite sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Colbert	4	1,140	1,919	4	1,079	1,986
Jefferson	9	3,622	5,105	6	3,025	4,413
Limestone	1	55	82	1	19	28
Shelby	10	4,458	7,068	10	4,961	7,641
Undistributed [1]	r 24	6,198	7,650	24	7,222	10,542
Total	r 48	15,473	21,824	45	16,306	24,610

r Revised.

[1] Includes Bibb, Calhoun, Covington (1972), De Kalb, Etowah, Franklin, Jackson, Lee, Madison, Marengo, Marshall, Morgan, St. Clair, Talladega, and Washington Counties.

Stone.—Total stone production was $18.5 million tons valued at $42,027,000. Limestone and dolomite were quarried and crushed at 45 quarries in 19 counties. Production of limestone and dolomite in 1972 was 16,306,000 tons, compared with $15.5 million tons in 1971, an increase of 5.4%. The 1972 production was valued at $24.6 million a 12.8% increase above the 1971 value of $21,824,000. Leading producing counties were Shelby and Jefferson. Production of crushed limestone and dolomite, by county, is shown in table 13. End use of the stone is shown in table 14.

Dimension limestone was quarried by one company at an underground operation in Franklin County. One company quarried dimension marble in Talladega County.

Three companies produced crushed and ground marble in Talladega County. Output decreased 7%. The crushed and ground marble was used primarily for extenders and fillers.

Oystershell from ancient oysterbeds was dredged from Mobile Bay by one company at two operations.

One company crushed granite in Elmore County.

Table 14.—Alabama: Crushed limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Bituminous aggregate	1,607	2,315	1,219	1,649
Concrete aggregate	3,152	4,066	1,552	2,295
Dense graded roadbase stone	1,078	1,313	1,199	1,619
Macadam aggregate	698	838	W	W
Surface treatment aggregate	195	287	W	W
Unspecified aggregate and roadstone	1,698	2,542	3,182	5,407
Agricultural limestone	679	1,162	541	942
Cement	3,389	3,370	3,489	4,029
Flux	451	1,112	487	1,080
Lime	1,347	2,576	1,331	2,666
Other uses [1]	1,178	2,244	3,304	4,922
Total [2]	15,473	21,824	16,306	24,610

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes stone used in refractories, chemicals, acid neutralization, railroad ballast, riprap, and jetty stone, and uses not specified. 1971 data also includes stone used in dam construction and filter stone.

[2] Data may not add to totals shown because of independent rounding.

Talc.—The American Talc Co., Inc., operated an open pit talc mine in Talladega County near Alpine. The talc was ground for export and for use in toilet preparations. In 1972, production of talc in Alabama decreased 50% below the 1971 quantity; value of production decreased 52%.

METALS

Aluminum.—Aluminum production increased 36%; the value was 40% above that of 1971.

Bauxite.—Alabama ranks second among the States in bauxite production. Five companies mined crude bauxite at eight pits in Barbour and Henry Counties. Production decreased 17% and total value decreased 40% from 1971.

Iron Ore.—Shipments of usable iron ore concentrate in 1972 totaled 326,812 tons, compared with 415,000 tons in 1971. Three companies strip-mined brown iron ore. Shipments include some stockpiled hematite.

Pig Iron.—Production of pig iron was 4,085,917 tons valued at $277,745,270, compared with 3,946,109 tons valued at $263.7 million in 1971.

Table 15.—Principal producers

Commodity and company	Address	Type of activity	County
Alumina: Aluminum Company of America.	1501 Alcoa Bldg. Pittsburgh, Pa. 15219	Plant	Mobile.
Aluminum smelters:			
Revere Copper & Brass, Inc.	Box 191 Rome, N.Y. 13440	----do----	Jackson.
Reynolds Metals Co	Reynolds Metals Bldg. Richmond, Va. 23218	----do----	Colbert.
Bauxite:			
Dresser Industries: Harbison-Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	Open pit mine and plant.	Henry.
Eufaula Bauxite Milling Co.	Box 556 Eufaula, Ala. 36027	----do----	Barbour.
United States Gypsum Co.: A. P. Green Refractories Co.	Mexico, Mo. 65265	5 open pit mines and plant.	Do.
Wilson-Snead Mining Co	Box 568 Eufaula, Ala. 36027	----do----	Barbour and Henry.

See footnotes at end of table.

Table 15.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Cement:			
Alpha Portland Industries, Inc.[1]	15 South Third St. Easton, Pa. 18058	Plant	Jefferson.
Ideal Basic Industries Inc.: Ideal Cement Co.	821 17th St. Denver, Colo. 80202	----do----	Mobile.
Lone Star Industries, Inc.	One Greenwich Plaza Greenwich, Conn. 06830	2 plants	Jefferson and Marengo.
Martin Marietta Corp.[2]	277 Park Ave. New York, N.Y. 10017	----do----	Jefferson and Shelby.
National Cement Co., Div. of Mead Corp.	Box 3358 Birmingham, Ala. 35205	Plant	St. Clair.
Universal Atlas Cement, Div. of United States Steel Corp.	600 Grant St. Pittsburgh, Pa. 15230	----do----	Jefferson.
Clays:			
Fire:			
R. T. Vanderbilt Co.: Dixie Clay Co.	Box 361 Anniston, Ala. 36202	Open pit mine and plant.	Calhoun.
Donoho Clay Co	Box 843 Anniston, Ala. 36202	----do----	Do.
Dresser Industries: Harbison-Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	2 open pit mines.	Henry and Walker.
Marigold Coal, Inc	Box 420 Jasper, Ala. 35501	Open pit mine.	Walker.
Common clay and shale:			
Bickerstaff City Products Co., Inc.	Box 1178 Columbus, Ga. 31902	4 open pit mines and plants.	Jefferson and Russell.
Glen-Gery Corp	Box 1656 East Canton, Ohio 44730	Open pit mine and plant.	Jefferson.
Ideal Basic Industries Inc.: Ideal Cement Company.	Ideal Cement Bldg. Denver, Colo. 80202	Open pit mine.	Mobile.
Jenkins Brick Co	Box 91 Montgomery, Ala. 36101	2 open pit mines and plants.	Elmore and Montgomery.
Marigold Coal, Inc	Box 420 Jasper, Ala. 35501	Open pit mine.	Walker.
Martin Marietta Corp	18th Floor Daniel Bldg. Birmingham, Ala. 35233	----do----	Shelby.
Mead Corp	Box 3358 Birmingham, Ala. 35205	Open pit mine and plant.	St. Clair.
Ragland Brick Co	3507 Rainbow Dr. Gadsden, Ala. 35901	----do----	Do.
Tombigbee Lightweight Aggregate Co.	Box 1247 Nashville, Tenn. 37202	----do----	Sumter.
United States Steel Corp.	600 Grant St. Pittsburgh, Pa. 15230	----do----	Jefferson.
Vulcan Materials Co.	Box 7324-A Birmingham, Ala. 35223	----do----	Do.
Kaolin:			
Dresser Industries:			
Harbison-Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	----do----	Henry.
Marigold Coal, Inc	Box 420 Jasper, Ala. 35501	----do----	Walker.
Thomas Alabama Kaolin Co.	15 Charles Plaza Baltimore, Md. 21201	Open pit mine.	Marion.
United States Gypsum Co.: A. P. Green Refractories Co.	Mexico, Mo. 65265	2 open pit mines and plants.	Barbour.

See footnotes at end of table.

Table 15.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal:			
Alabama By-Products Corp.	Box 354 Birmingham, Ala. 35210	3 underground, 1 strip mine and 2 plants.	Jefferson.
Arch Minerals Corp	400 Mansion House Center St. Louis, Mo. 63100	Strip mine	Jackson.
Peabody Coal Co	301 N. Memorial Dr. St. Louis, Mo. 63102	2 strip mines and plants.	Tuscaloosa.
Southern Electric Generating Co.	600 North 18th St. Birmingham, Ala. 35203	Underground mine and plant.	Walker.
United States Steel Corp	Box 599 Fairfield, Ala. 35064	do	Jefferson.
Woodward Co	Woodward, Ala. 35189	2 underground mines and plants.	Do.
Coke:			
Alabama By-Products Corp.	Box 354 Birmingham, Ala. 35210	Plant	Do.
Empire Coke Co	2201 First Ave., North Birmingham, Ala. 35203	do	Tuscaloosa.
Republic Steel Corp	Box 6778 Cleveland, Ohio 44101	2 plants	Etowah and Jefferson.
U.S. Pipe & Foundry Co.	3300 First Ave. North Birmingham, Ala. 35202	Plant	Jefferson.
United States Steel Corp	600 Grant Street Pittsburgh, Pa. 15230	do	Do.
Woodward Co	Woodward, Ala. 35189	do	Do.
Ferroalloys:			
Airco Alloys and Carbide	P.O Box 368 Niagara Falls, N.Y. 14302	do	Mobile.
Alabama Metallurgical Corp.	Box 348 Selma, Ala. 36701	do	Selma.
Tennessee Alloys Corp	818 National Bank Bldg. Chattanooga, Ala. 37402	do	Jackson.
Tennessee Valley Authority.	Muscle Shoals, Ala. 35660	do	Colbert.
Union Carbide Corp., Ferroalloys Div.	Marietta Financial Control Center Box 176 Marietta, Ohio 45750	2 plants	Colbert and Jefferson.
Woodward Co	Woodward, Ala. 35189	Plant	Jefferson.
Iron ore:			
Limonite:			
Shook & Fletcher Supply Co.	Box 2686 Birmingham, Ala. 35202	do	Franklin.
U.S. Pipe & Foundry Co.	3300 First Ave., North Birmingham, Ala. 35202	do	Do.
Lime:			
Alabaster Lime Co	Siluria, Ala. 35144	Limekiln and plant.	Shelby.
Allied Products Co	Drawer 1 Montelvallo, Ala. 35115	do	Do.
Cheney Lime & Cement Co.	Algood, Ala. 35013	do	Do.
Longview Lime Co	Woodward, Ala. 35189	do	Do.
Martin Marietta Cement	18th Floor Daniel Bldg. Birmingham, Ala. 35233	do	Do.
Southern Cement Co	18th Floor Daniel Bldg. Birmingham, Ala. 35233	do	Do.
Mica, flake: United States Gypsum Co.	101 South Wacker Dr. Chicago, Ill. 60606	Open pit mine and plant.	Randolph.
Natural gas: Black Warrior Petroleum Co., Inc.	Box 1642 Mobile, Ala. 36601	Gasfield	Escambia.
Natural gas liquids, including LPG and natural gasoline: Cities Service Oil Co.	Box 300 Tulsa, Okla. 74102	Plant	Mobile.
Petroleum:			
Crude:			
Ancora Corp	1 Jackson Pl., Suite 620 San Francisco, Calif. 94111	Citronelle field.	Do.
E. L. Erickson	1235 Petroleum Bldg. Jackson, Miss. 39201	Toxey field	Choctaw.
Humble Oil & Refining Co.	Box 2180 Houston, Tex. 77001	Flomation field. Little Escambia Creek field.	Escambia. Do.
Louisiana Land & Exploration Co.	Box 60350 New Orleans, La. 70160	do	Do.
Patrick Petroleum	744 Michigan Ave. Jackson, Mich. 49201	South Carlton field.	Clarke and Baldwin.

See footnotes at end of table.

Table 15.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum—Continued			
Crude—Continued			
Pruett & Hughes Co	390 Petroleum Bldg. Jackson, Miss. 39201	Choctaw Ridge field.	Choctaw.
Sun Oil Co	Box 2880 Dallas, Tex. 75221	Citronelle field	Mobile.
Refineries:			
Alabama Refining Co	Mobile, Ala. 36600	Plant	Do.
Hunt Oil Co	Tuscaloosa, Ala. 35401	do	Tuscaloosa.
Vulcan Asphalt Refining Co.	Cordova, Ala. 35550	do	Walker.
Warrior Asphalt Co	Tuscaloosa, Ala. 35401	do	Tuscaloosa.
Pig iron:			
Republic Steel Corp	1629 Republic Bldg. Cleveland, Ohio 44115	Blast furnaces and mills.	Etowah and Jefferson.
U.S. Pipe & Foundry Co	Box 2651 Birmingham, Ala. 35202	do	Jefferson.
United States Steel Corp	Box 599 Fairfield, Ala. 35064	do	Do.
Woodward Co	Woodward, Ala. 35189	do	Do.
Salt: Olin Corp	120 Long Ridge Rd. Stanford, Conn. 06904	Brine wells	Washington.
Sand and gravel:			
Dixie Sand & Gravel	Box 1128 Montgomery, Ala. 36102	4 dredges and 1 plant.	Montgomery.
Radcliff Materials, Inc	Mobile, Ala. 36601	Dredge	Mobile.
W. T. Ratliff Co., Inc	Box 1111 Knoxville, Tenn. 37901	Open pit mine and plant.	Clarke.
Southern Indus. Co	61 St. Joseph Mobile, Ala. 36602	Pit and dredge.	Elmore and Montgomery.
Vulcan Materials Co	Box 7324-A Birmingham, Ala. 35233	2 open pit mines and plants.	Do.
Stone:			
Dolomite:			
Southern Stone Co., Inc.	2111 8th Ave., South Birmingham, Ala. 35233	Quarry and plant.	Shelby.
U.S. Pipe & Foundry Co.	3300 First Ave., North Birmingham, Ala. 35202	do	Jefferson.
United States Steel Corp.	Box 599 Birmingham, Ala. 35064	3 quarries and plants.	Do.
Limestone, crushed:			
Lone Star Industries, Inc.	Box 6237 West End Br. Richmond, Va. 23230	4 quarries and plants.	Jefferson, Marengo, Washington.
Madison Limestone Co., Inc.	Box 46 Huntsville, Ala. 35804	do	Madison.
Martin Marietta Corp	18th Floor Daniel Bldg. Birmingham, Ala. 35223	2 quarries and plants.	Shelby.
Vulcan Materials Co	Box 7324-A Birmingham, Ala. 35223	6 quarries and plants.	Colbert, Etowah, Franklin, Jackson Shelby.
Limestone, dimension:			
Georgia Marble Co	Russellville, Ala. 35653	do	Franklin.
Marble, crushed:			
Georgia Marble Co	Gantts Quarry, Ala. 35069	2 quarries and plant.	Talladega.
Moretti-Harrah Marble Co.	Box 330 Sylacauga, Ala. 35150	Quarry and pit.	Do.
Thompson-Weinman & Co.	Cartersville, Ga. 30120	2 quarries and plant.	Do.
Oystershell: Radcliff Materials, Inc.	Box 1288 Mobile, Ala. 36601	2 dredges and plants.	Mobile.
Sandstone, crushed:			
Enos Vann	Box 246 Trussville, Ala. 35173	do	Jefferson.
United States Steel Corp.	Box 2969 Pittsburgh, Pa. 15230	2 quarries and plants.	Do.
Talc: American Talc Co., Inc	Alpine, Ala. 35014	Open pit mine and plant.	Talladega.

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[1] Portland and masonry cement.
[2] Portland, masonry, and slag cement.

The Mineral Industry of Alaska

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Alaska Department of Natural Resources, for collecting information on all minerals.

By William B. Harper[1] and Donald C. Hartman[2]

The uncertainty concerning the trans-Alaska pipeline, including issuance of a construction permit by the U.S. Department of the Interior, and other required approvals both Federal and State, dominated the Alaska scene in 1972. Also unresolved was a withdrawal of some 80 million acres of public interest lands authorized by a provision in the Alaska Native Claims Settlement Act (H.R. 10367). A favorable development was that reserves in the Lost River fluorite mine may last more than 30 years rather than the originally estimated 20 years.

Interest was developing in a trans-Alaska gas pipeline contemplated by El Paso Natural Gas Company. The $3 billion project would entail 800 miles of new pipeline from Prudhoe Bay to an ice-free port in southern Alaska. North Slope gas would then be moved to where it would be liquefied and shipped to the west coast of the United States.

A competing proposal to move natural gas from Prudhoe Bay and possibly other nearby gas including that from the Mackenzie Valley and the Arctic Islands is being prepared by an Arctic gas study consortium. This proposal would route natural gas through Canada to the Midwest of the United States. Ownership in the line would be split, 51% resting with Canada.

The total value of mineral production in 1972 was $286.1 million, a decrease of $36.7 million or 11.4% below the revised 1971 figure of $322.8 million. A 6.6-million barrel drop in petroleum production accounted for $22 million of the decrease. Also, sand and gravel and stone declined about $19.6 million. Offsetting in part, at least, were increases in the production of barite, coal, and natural gas liquids in 1972. In terms of value, petroleum accounted for 82.3% of the total value of mineral production in the State.

Legislation and Government Programs.—Since the signing of the Alaska Native Claims Settlement Act on December 18, 1971, by President Nixon, several significant issues concerning much of Alaska's 365 million acres (excluding water bottoms) are outstanding. The most significant of these is a proposal expected to be presented to the U.S. Congress in the form of a recommendation to withdraw about 80 million acres of public interest lands in Alaska. The recommendation is to be submitted in time to meet the December 18, 1973 deadline, as provided for in the Settlement Act.

The withdrawal of these lands is the outcome of a provision in the Native Claims Settlement Act allowing for up to 80 million acres to be withdrawn from all forms of appropriation under U.S. mining laws and from operation of the mineral leasing laws. Also, the expected withdrawal, which is being proposed in accordance with the Section 17(d)(2) provision of the Act, excludes the 80 million acres from selection by Natives. The Natives have the right to pick 40 million acres on the basis of population and other factors. Mining could be permitted on approximately 20 million of the acres withdrawn. Congress has until December 18, 1978 to act on the withdrawal in that the special d–2 orders will expire on that date. In an earlier land-related action in January 1972, the State selected for its use approximately 77 million acres. This was the remainder of the Federal land that was due to the State under the Statehood Act providing for the selection of 104 million acres.

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[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

[2] State geologist, Division of Geological and Geophysical Surveys, Department of Natural Resources, State of Alaska, Anchorage, Alaska.

Table 1.—Mineral production in Alaska[1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Antimony ore and concentrate short tons, antimony content	(2)	(2)	--	--
Barite thousand short tons	102	$1,075	W	W
Coal (bituminous) do	698	5,710	668	W
Gem stones	W	W	NA	$57
Gold (recoverable content of ores, etc.) troy ounces	13,012	537	8,639	506
Natural gas million cubic feet	121,618	r 17,878	125,596	18,463
Petroleum (crude) thousand 42-gallon barrels	79,494	257,562	72,893	235,444
Sand and gravel thousand short tons	23,617	32,806	14,187	15,214
Silver (recoverable content of ores, etc.) thousand troy ounces	1	1	(3)	(3)
Stone thousand short tons	2,658	5,066	652	3,012
Tin long tons	17	47	W	W
Value of items that cannot be disclosed: Barite (1972), coal (1972), gemstones (1971), mercury, natural gas liquids (1972), platinum-group metals, tin (1972), uranium, and values indicated by symbol W	XX	r 2,141	XX	13,442
Total	XX	r 322,823	XX	286,138
Total 1967 constant dollar	XX	274,496	XX	p 238,038

p Preliminary. r Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] No production of antimony was reported to the Bureau of Mines. However, the Alaska Department of Natural Resources reported 34 tons at approximately $34,000.

[3] Less than ½ unit.

Table 2.—Value of mineral production in Alaska, by region[1]

(Thousands)

Region	1971	1972	Minerals produced in 1972 in order of value
Alaska Peninsula	--	(2)	Sand and gravel.
Aleutian Islands	$36	$1,898	Stone.
Bristol Bay	141	753	Sand and gravel.
Cook Inlet-Susitna	r 243,601	230,065	Petroleum, natural gas, sand and gravel, stone, gold.
Copper River	W	W	Sand and gravel, stone, gold.
Kenai Peninsula	38,469	31,792	Petroleum, natural gas liquids, sand and gravel, stone.
Kodiak	W	W	Sand and gravel.
Kuskokwim	W	W	Platinum-group metals, mercury, sand and gravel, gold.
Northern Alaska	3,789	827	Petroleum, sand and gravel.
Northwestern Alaska	W	W	Sand and gravel.
Seward Peninsula	W	W	Sand and gravel, tin, stone, gold.
Southeastern Alaska	W	5,446	Barite, uranium, sand and gravel, stone.
Yukon River	22,158	12,452	Sand and gravel, coal, gold, silver.
Undistributed[3]	r 14,629	2,906	
Total	r 322,823	[4] 286,138	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] No production was reported in the Bering Sea region.

[2] Less than ½ unit.

[3] Includes gem stones and some sand and gravel and stone that cannot be assigned to specific regions.

[4] Data do not add to total shown because of independent rounding.

Table 3.—Indicators of Alaska business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force thousands	123.4	131.5	+6.6
Unemployment do	12.8	13.7	+7.0
Employment:			
Construction do	7.5	7.5	--
Mining do	2.4	2.4	--
Transportation and public utilities do	9.9	10.3	+4.0
Wholesale and retail trade do	16.2	16.7	+3.1
Manufacturing do	7.8	8.1	+3.8
Services do	12.8	13.8	+7.8
Government do	37.9	40.7	+7.4
Finance, insurance, and real estate do	3.3	3.5	+6.1
Personal income:			
Total millions	$1,525	$1,678	+10.0
Per capita	$4,875	$5,162	+5.9
Construction activity:			
Value of authorized nonresidential construction millions	$20.9	$24.8	+18.7
Number of authorized, new housing units	1,754	2,427	+38.4
Highway construction contracts awarded millions	$31.1	[e] $50.0	+60.8
Mineral production value do	$322.8	$286.1	−11.4
Foreign trade:			
Exports do	$128.5	$183.4	+42.7
Imports do	$41.3	$49.0	+18.6

[e] Estimate. [p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings, May 1973; Construction Review; Highlights of U.S. Import and Export Trade; and U.S. Bureau of Mines.

Table 4.—Working and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	161	160	26	228	--	18	78.93	NA
Metal	221	152	34	289	--	17	58.88	1,139
Nonmetal	13	260	3	27	--	--	--	--
Sand and gravel	1,077	184	198	1,559	--	41	26.30	703
Stone	359	239	86	685	--	17	24.80	516
Total	1,831	189	[1] 346	2,788	--	93	33.35	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	130	155	21	168	--	2	11.94	1,522
Nonmetal	20	236	4	34	--	--	--	--
Sand and gravel	135	90	12	118	1	5	50.98	51,251
Stone	15	33	([3])	3	--	1	288.43	14,422
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data do not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

[3] Less than 500.

Table 5.—Alaska: Expenditures by major companies for exploration, excluding petroleum

(Thousands)

Region	1968	1969	1970	1971	1972
Arctic Alaska	$710	NA	$775	$850	$400
Interior Alaska	120	NA	1,325	1,100	400
Western Alaska	1,240	NA	1,225	1,500	2,400
Southwestern Alaska	50	NA	150	150	--
South-central Alaska	850	NA	1,100	1,400	NA
Southeastern Alaska	1,540	NA	2,275	4,000	2,800
Total	4,510	$6,900	6,850	9,000	6,000

NA Not available.

Source: State of Alaska Department of Natural Resources, Division of Geological Survey.

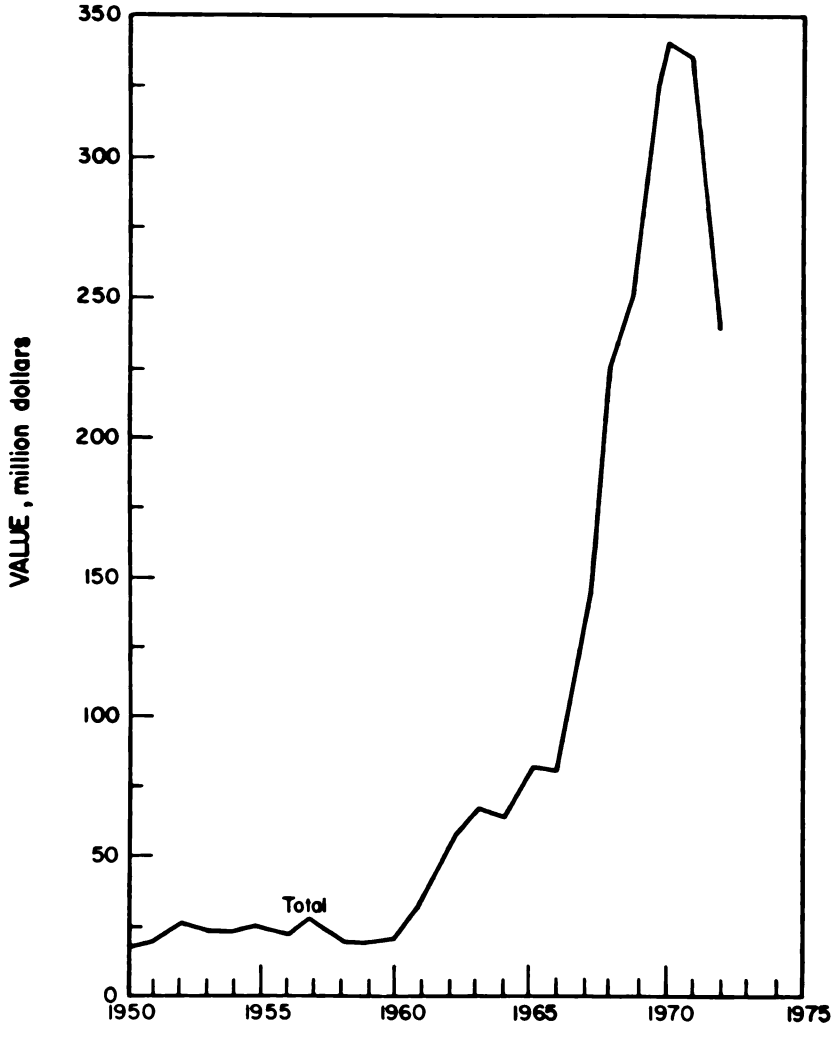

Figure 1.—Total value of mineral production in Alaska.

In accordance with another provision of the Native Claims Act, section 17(d)(1), Secretary of the Interior Morton had withdrawn some 47 million acres into a d–1 category in an action which met the March 17, 1972 deadline specified in the Act. No mining or oil prospecting will be permitted on d–1 lands. Unlike d–2 lands, however, d–1 lands are not frozen into a specific management system such as national park, forest, wildlife refuge and wild and scenic rivers designations. Unless existing d–1 orders are modified, any of the 80 million acres would revert to d–1 status if Congress should fail to endorse the proposal by the 1978 deadline.

A conflict arose in March 1972 when Secretary Morton made preliminary withdrawals of village and regional cooperation deficiency areas and of multiple use lands because some 42 million acres of the 77 million acres of the State withdrawal lands were included in both plans. This was resolved in September 1972 by an agreement between Secretary Morton and Governor Egan wherein the Federal withdrawal plan prevailed.

Opposition to the 80-million-acre withdrawal plan can be expected at the State level because potentially valuable mineral lands would be set aside and would not be prospected for coal, oil, copper, and other valuable minerals. However, the 40 million acres, which the estimated 90,000 Eskimos, Indians, and Aleuts are entitled to select, can be opened up to such prospecting. Management authority for all lands at issue will be the Bureau of Land Management in the U.S. Department of the Interior. Making recommendations in matters concerning disposition of lands will be the Federal-State Land Use Planning Commission which is an outgrowth of the Native Claims Settlement Act. This group is the principal advisor to Secretary Morton and the U.S. Congress concerning land use recommendations in Alaska. Also, the National Park Service, the Bureau of Sport Fisheries and Wildlife, the Bureau of Outdoor Recreation, and the U.S. Forest Service, have all established task force groups to formulate proposals for utilization of the d–2 lands.

The State of Alaska is expected to enact legislation in which the production tax would be raised on an escalating basis. A ruling by the Alaska Supreme Court affecting communities' taxing rights is expected to be sought by oil companies with arctic holdings. Namely, if upheld, the North Slope Borough created in mid-1972 would have the right of taxation and this taxation would be challenged on the basis that the borough was not properly brought into existence. Another significant court proceeding involved a U.S. district court which ruled in favor of Alaska in an action wherein Lower Cook Inlet lands were in dispute between the U.S. Government and the State. The issue was one of jurisdiction to set up a lease sale of Lower Cook Inlet lands. The decision in favor of Alaska was rendered in December 1972. An appeal to the United States Court of Appeals for the Ninth Circuit is expected.

Trans-Alaska Pipeline.—On August 15, 1972, the District Court of the United States for the District of Columbia dissolved a 2-year injunction which prohibited the construction of the trans-Alaska crude pipeline. Earlier, on May 11, 1972, Secretary Morton had approved construction of the oil line to Valdez from Prudhoe Bay on the North Slope. However, environmentalists promptly filed another action in the district court to block construction. The action was based on a provision in the Mineral Leasing Act of 1920. That provision specified a right-of-way not to exceed 25 feet on either side of a line whereas the Trans-Alaska Pipeline Service (TAPS) proposal included a 100-feet right-of-way. The action was filed by the same group that had obtained the original injunction 2 years earlier.

In reaching the August 15, 1972 decision, the District court held that the U.S. Department of the Interior's environmental impact statement meets the requirements of the National Environmental Policy Act. Also, the court emphasized that the matters involved are "highly important for all people in this country" and added that it is necessary for the case to move through the appellate process to the Supreme Court of the United States as soon as possible. An appeal of this decision by the environmentalists to the Circuit Court of the District of Columbia is anticipated.

Transportation.—With the upcoming opening of the North Slope, Wien Consolidated Airlines Inc., the only Federally certified jet carrier for North Slope traffic, anticipates that the demand for air transportation in Alaska will grow. Wien expects an improvement over a prior 3-year period of depressed business. In other airline events, Alaska Airlines was notified to discontinue its Nome route in September 1972 but was notified in November 1972 that the discontinuance order was withdrawn. The withdrawal stems from an action in the United States Court of Appeals, concerning a challenge by Western Airlines to an earlier CAB order awarding Alaska Airlines 5 years of exclusive service in Alaska's Panhandle routes and suspending Western from southeast Alaska runs. Subsequently, the Court of Appeals ruled that Alaska Airlines will have exclusive rights to southeast Alaska for the next 7 years. Final disposition of awarding of routes awaits the court's decision. Reeve Aleutian Airways continued to serve the Aleutian Island chain and has added two passager planes to its fleet.

Airport construction and improvement work continued in 1972. The 1972 construction program was the largest in the history of the Alaska Division of Aviation involving 42 projects totaling over $33 million. A $24 million bond issue for trunk and secondary airports was approved. However, the general slowdown in the rate of growth of the State's economy was reflected in a slight decrease in freight with a comparable number of passengers handled at Anchorage and Fairbanks.

On the Alaska marine highway system traffic rose a moderate 6% over the 1971 level. The system now extends over 2,200 miles connecting some 17 communities throughout Alaska as well as connecting these communities with Prince Rupert, Canada, and Seattle, Wash. A new 418-foot ferry with oceangoing capability is being built in Seattle and will become the flagship of the Alaska marine highway fleet. A second vessel, a 235-foot ferry being built in Wisconsin, will be added and will operate exclusively in southeastern Alaska where most of the population depends on the waterway system. The Alaska marine highway established new highs in revenues as well as new highs for the transportation of passengers in 1972. Some 200,000 passengers and nearly 50,000 vehicles utilized the seven vessels in the fleet. Revenue in 1972 approached $10 million. Estimates are that by 1985 about 1 million passengers will be using the system.

Construction of a new dock and crane facility at Kodiak is expected to contribute to the use of that city as a western Alaska shipping center. At nearby Woman's Bay, a boat repair facility is to be upgraded to a full service and repair shipyard. During 1972, a total of 53 marine-related projects were started, under construction, or completed with over $3.25 million being expended during the year. Legislative action

Table 6.—Alaska: Coastwise receipts and foreign mineral trade

(Short tons)

Commodity	1970			1971		
	Coastwise receipts	Imports	Exports	Coastwise receipts	Imports	Exports
Bituminous coal and lignite	21	--	--	--	--	--
Gasoline, including natural gasoline	364,796	45,605	2,613	416,616	22,170	--
Kerosine	[r] 141,502	[r] 411,505	--	228,550	495,993	--
Distillate fuel oil	[r] 677,383	--	--	695,315	--	--
Residual fuel oil	[r] 138,226	[r] 2,495	--	208,695	--	5,488
Asphalt, tar, pitches	25,375	--	--	11,922	--	--
Lubricating oil and greases	8,916	--	--	1,662	2	--
Petroleum and coal products, not elsewhere classified	15,678	140,028	--	11,922	--	--
Building cement	31,776	45,686	--	56,265	19,239	--
Building stone, unworked	--	--	--	--	--	--
Clay, ceramic and refractory materials	7,141	--	--	5,589	--	--
Structural clay products including refractories	3,898	6	--	1,324	77	--
Sulfur, dry and liquid	12,429	7,136	--	11,600	5,924	--
Sand, gravel and crushed rock	169,455	28,243	--	17,206	1,710	--
Iron ore and concentrates	--	--	--	--	--	--
Iron and steel scrap	125	--	--	607	801	629
Primary iron and steel products	29,080	276,352	--	71,261	71,166	--
Aluminum and aluminum alloys, unworked	447	--	--	97	--	--
Lead and zinc including alloys, unworked	--	--	--	--	--	--
Nonferrous metal ores and concentrates	1	--	585,875	4	--	718,570
Nonferrous metals, primary smelter products, basic shapes, wire, casting and forgings, except copper, lead, zinc, and aluminum	2,843	1	--	1,248	744	--
Chemical fertilizer and fertilizer materials	113	--	--	4,313	--	--

[r] Revised.

Source: U.S. Army Corps of Engineers. Waterborne Commerce of the United States. Pt. 4, Pacific Coast, Alaska and Pacific Islands.

Table 7.—Freight rates, Seattle to selected Alaskan cities in Hydro-Train service[1]

(Cents per hundred pounds)

	Minimum Shipment (thousand pounds)	From Seattle, via Whittier, to—					
		Anchorage effective		Fairbanks effective		Seward effective	
		Dec. 31, 1972	Aug. 13, 1973	Dec. 31, 1972	Aug. 13, 1973	Dec. 31, 1972	Aug. 13, 1973
Groceries	60	243	260	308	330	--	--
Do	80	193	207	258	276	--	--
Do	[2]100	115	123	182	195	--	--
Iron or steel articles	50	289	309	390	417	289	309
Do	80	198	212	277	296	198	212
Do	100	187	200	266	285	187	200
Machinery	60	274	293	322	345	259	277
Do	80	236	253	284	304	220	235
Do	100	224	240	272	291	209	224
Lumber	80	190	203	260	278	191	204
Do	100	179	192	249	266	181	194
Do	120	176	188	--	--	--	--
Ores and concentrates (southbound)[3]	60	121	129	161	172	--	--
Do	80	102	109	148	158	--	--
Do	100	97	104	137	147	--	--
Petroleum and products	60	234	250	343	367	234	250
Do	80	195	209	304	325	195	209
Do	100	184	197	293	314	184	197

[1] Rates include all-risk insurance.

[2] Excess over 80,000-pound minimum when loaded in or on same car.

[3] Value not to exceed $60 per ton; rate increases 25% for each additional $60 (or fraction) per ton valuation.

Source: Alaska Hydro-Train, Division of Puget Sound Tug and Barge Co.

in 1972 saw passage and voter verification of a $20 million proposal for small-boat harbor and flood control projects. The Alaska marine highway system, important to tourism, will contribute much to the State's total revenue.

The 450-foot main span of the John W. O'Connell Bridge in Sitka, has been instrumented for a 2-year test to investigate the aerodynamic behavior of the cable-stayed girder bridge under the high-wind conditions existing at Sitka. This project is sponsored jointly by the Alaskan Department of Highways and the Federal Highway Administration of the U.S. Department of Transportation. The purpose is to gain data which could allow use of this economical type of construction on larger spans. The construction of another span, the proposed Knik Arm causeway at Anchorage, seems unlikely for the present, due to lack of funding. Estimated cost of the causeway increased from $140 million to $200 million compared with a statewide allowable Federal funding of $35 million annually.

An agreement has been reached with British Columbia to construct a road between Skagway and the Carcross Road in the Yukon Territory. In another development, the Alaska Department of Highways design of the Yukon River Bridge is almost complete with the help of Alyeska Pipeline Service Company engineers. It is included in the final design for the haul road from Livengood, some 75 miles north of Fairbanks, to Prudhoe Bay.

Table 8.—Alaska: Leases and acreage under Federal supervision, at yearend

Year	Oil and gas leases		Mining leases	
	No. leases	Acres (thousands)	No. leases	Acres (thousands)
1968	4,147	6,841	16	20
1969	4,290	6,936	13	16
1970	3,638	6,168	14	16
1971	2,926	5,344	13	16
1972	2,641	4,832	13	16

Source: U.S. Geological Survey.

The Alaska Railroad, operated by the U.S. Department of Transportation, experienced a slowdown in freight demand, which has been related to the lull in oil development. The railroad, which is experiencing sagging revenues and does not receive any Federal subsidy, has been reported to be up for sale at a price of some $100 million but no prospective buyers have appeared.

Employment.—All civilian nonagricultural employment increased 6.8% in 1972, to include 104,200 workers[3]. Employment in 1972 totaled 117,600 or 6.4% more than in

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[3] State of Alaska, Department of Economical Development. A Performance Report of the Alaskan Economy Mid-Year Review. July 1973.

1971. The largest category which is in local, State, and Federal Government employment rose 6.8% to aggregate 40,500 in 1972. Unemployment rate reached a rate of 10.4% of the total work force during the year.

Mining employment, conversely, showed a decrease of 13.1% from 1971 figures and is at its lowest level since 1967. There were 2,300 workers on the average in mining during 1972 with a payroll of just over $39 million as reported by the Alaska Department of Labor. Crude petroleum and natural gas contributed in excess of $34.6 million, employing an average of 1,792 workers in 1972. These values are expected to increase substantially with the development of the North Slope oil province which will result from accelerating activity related to the trans-Alaska oil pipeline.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Production of coal declined slightly from the level of 1971. Source of the coal in the winter of 1972 was three mines but two mines shut down with the approach of summer leaving only one mine, the Usibelli, near Healy in operation. The Usibelli coal mine in the Nenana coalfield, active during the summer and fall of 1972, supplies military bases north of the Alaska range and electric generating plants in Fairbanks. Exploration for new coal reserves was concentrated in the Beluga area. A limited amount of exploration work took place in the Nenana area. Exploratory work sponsored by the State Conservation Section of the Alaska Division of Geological and Geophysical Surveys was directed toward correlating Tertiary coal deposits in Central Alaska. In a specific-community study, an investigation of some coalfields from Palmer to the North Slope was made under State sponsorship. Bureau of Mines feasibility studies of coking coals in the western part of the North Slope continued with the drilling of coal deposits at Cape Beaufort/Point Lay.

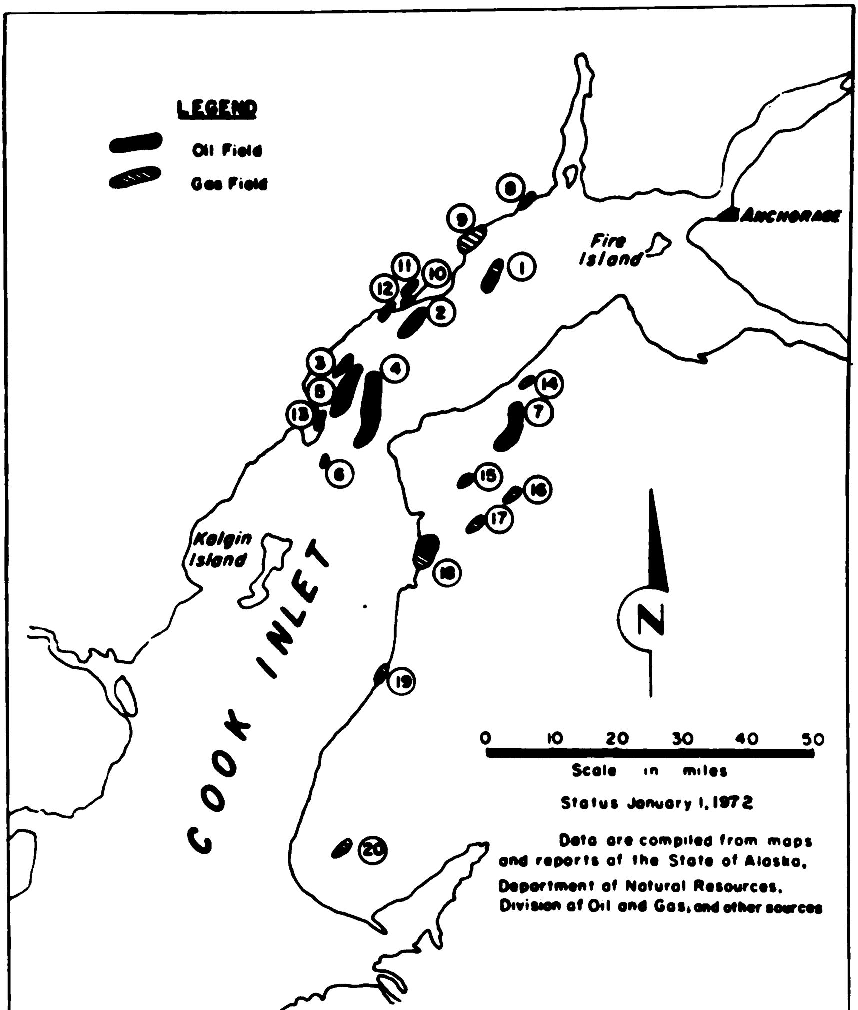
Petroleum and Natural Gas.—Crude petroleum continued to be the leading revenue producer among all minerals in Alaska despite a decrease of 6.6 million barrels or 8.3% in production during 1972. Likewise, values of crude petroleum also declined to $235.4 million or nearly 8.6%, as shown in table 1. Production in five of the six fields declined with the sharpest reductions occurring in the Swanson River and the Middle Ground Shoal fields. In 1972, production in the Swanson River field decreased from 11.5 to 8.9 million barrels or 22%, according to the Alaska Division of Oil and Gas in the State's Department of Natural Resources. The second largest reduction was in the Middle Ground Shoal field. Production dropped from 11.3 million barrels in 1971 to 9.7 million barrels in 1972 or 14%. Likewise, production in the Granite Point field was some 900,000 barrels below the 1971 level. A slight gain in production at the McArthur River field more than offset the decline at Prudhoe Bay in 1972. The McArthur River field, however, is the most prolific of all the fields in Alaska. According to the Alaska Division of Oil and Gas, the field accounted for 55.4% of all oil produced in the State. From 21.8 million barrels in 1968, production climbed to 40.2 million barrels in 1970 and has been inching upward since then, as shown in table 10.

According to State data, overall production, however, has declined since 1970 from 83.6 million barrels to about 73.6 million barrels in 1972, a decrease of 12%. This decrease in production could be arrested by the end of 1974 as a result of drilling activity following the Cook Inlet lease sale in 1972 and another sale anticipated in 1973.

According to the Alaska Division of Oil and Gas, oil produced was from five fields in the Cook Inlet area with a small amount coming from the North Slope.

Total production of natural gas aggregated nearly 222.9 billion cubic feet in 1972. Of the total, 126.2 billion cubic feet was derived from gas wells and the remaining 96.7 billion cubic feet was from oil wells. Of the total, some 72 billion cubic feet was used in repressuring. It is estimated that about 33.8 billion cubic feet or 15% was lost at the producing properties primarily by venting and flaring. Marketed production of natural gas increased a moderate 3.3% over that of 1971. All gas produced was from the Cook Inlet area and the South Barrow gasfield.

In line with the Alaska Oil and Gas Conservation Committee order prohibiting flaring of gas from wells in Cook Inlet fields,



Status January 1, 1972

Data are compiled from maps and reports of the State of Alaska, Department of Natural Resources, Division of Oil and Gas, and other sources

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OIL FIELDS

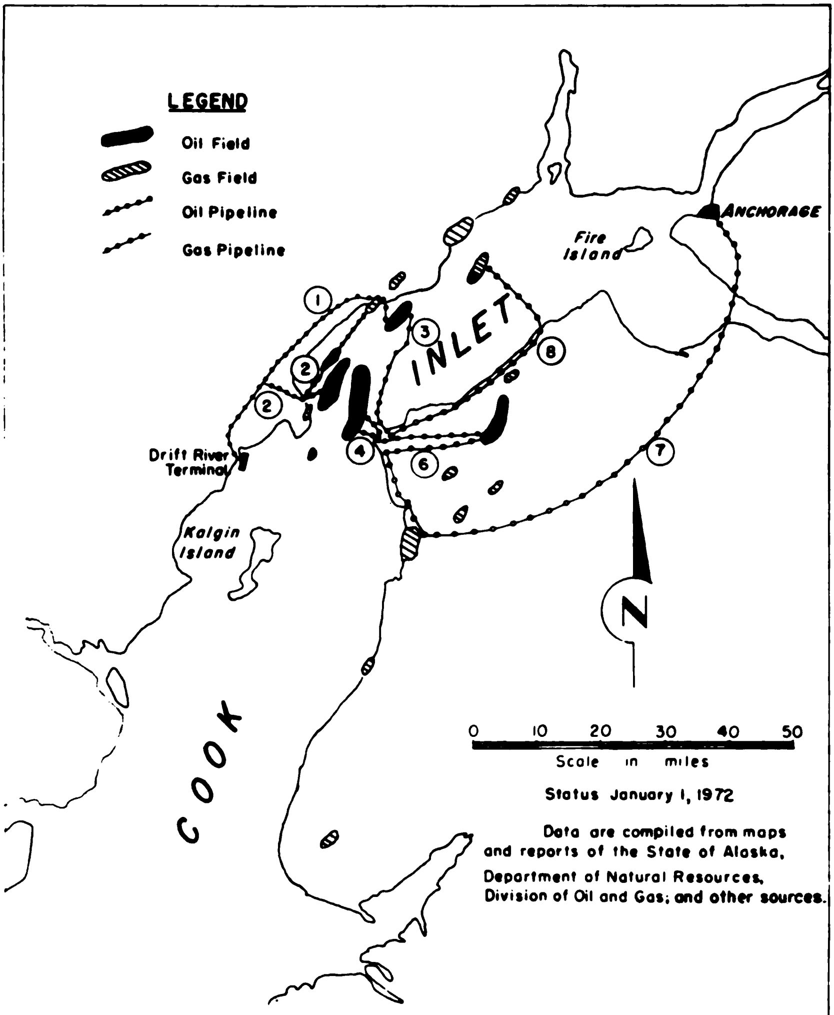
2.	Granite Point
3.	Trading Bay
4.	Middle Ground Shoal
5.	Mc Arthur River
6.	Redoubt Shoal
7.	Swanson River

Note:
Field outlines and names are subject to change with progress of development drilling.

GAS FIELD

1.	North Cook Inlet
8.	Ivan River
9.	Beluga River
10.	Kalea
11.	Moquawkie
12.	Nicolai Creek
13.	West Foreland
14.	Birch Hill
15.	Beaver Creek
16.	West Fork
17.	Sterling
18.	Kenai
19.	Falls Creek
20.	North Fork

Figure 2.—Cook Inlet oilfields and gasfields.



Status January 1, 1972

Data are compiled from maps and reports of the State of Alaska, Department of Natural Resources, Division of Oil and Gas; and other sources.

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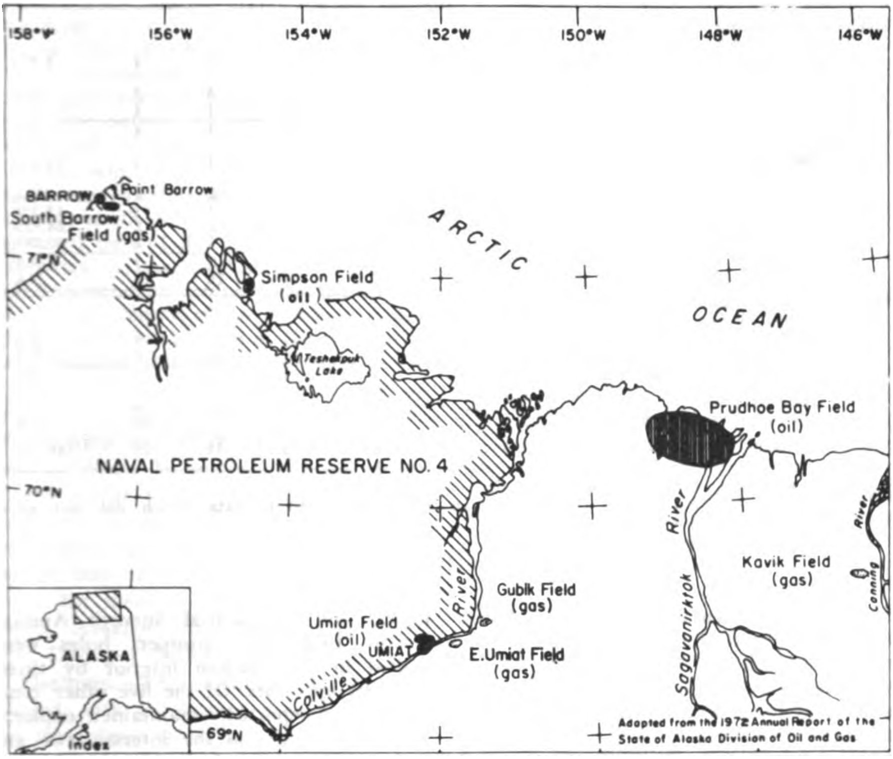
PIPELINES

1. Granite Point to Drift River. - Oil
2. Trading Bay Field and Trading Bay Unit to Drift River. - Oil
3. Granite Point to Nikishka. - Oil
4. Middle Ground Shoal to Nikishka. - Oil (2)
5. Swanson River to Refinery - Oil
6. Kenai to Swanson River. - Gas
7. Kenai to Anchorage. - Gas
8. North Cook Inlet to liquefication - Gas

Figure 3.—Cook Inlet oil and gas pipelines.



Adapted from the 1972 Annual Report of the State of Alaska Division of Oil and Gas

Figure 4.—Oilfields and gasfields of the Arctic North Slope.

work on a gas-gathering system was under way in 1972. The system, when completed, will be able to handle all Cook Inlet gas. A 26-mile pipeline which collects wet gas from offshore Cook Inlet operations was completed on the west shore of Cook Inlet. The second stage of the project will be to install twin 10-inch lines underneath the inlet connecting the west side of the inlet with facilities at East Foreland. The gas will then be collected with some of the gas being used to fuel the Collier Carbon & Chemical Co. plant near Nikiski, and the rest will be transmitted to the Swanson River field where it will be compressed and reinjected as part of the reservoir pressurization program.

Operational necessities still cause some gas to be flared because of mechanical repairs and submarine pipeline leaks. These cases are reviewed for compliance with the various conservation orders and administrative approval is issued, if justified.

According to the American Petroleum Institute (API),[4] the total number of wells drilled in Alaska classified[5] as "drilled during 1972" decreased to 26 wells from the 1971 level of 32 wells. This is 77% below the 1970 alltime high of 112 wells. Half of the 26 wells were exploratory and seven of these were drilled on the North Slope. There was one successful completion consisting of a gas well on the North Slope but there was no new oil discoveries in 1972. The one discovery was Forest Oil

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[4] American Petroleum Institute. Quarterly Review of Drilling Statistics for the United States, Annual Summary, 1972, pp. 14–15.

[5] Definitions of API well counts: American Petroleum Institute. Standard Definitions for Petroleum Statistics. Tech. Rept. 1, 1969, pp. 22–30.

Table 9.—Oil well drilling in Alaska

Province and Area	Wells				Footage
	Oil	Gas	Dry	Total	
Exploratory drilling:					
Southwest Area:					
Kuskowin River	--	--	1	1	6,370
Cook Inlet Basin:					
Kenai	--	--	3	3	NA
Tyonek	--	--	1	1	NA
Total	--	--	4	4	NA
Alaska Peninsula:					
Chignik	--	--	1	1	15,015
North Slope:					
Beechey Point	--	--	2	2	NA
Flaxman	--	--	1	1	13,329
Harrison Bay	--	--	2	2	24,620
Sagavanirtok	--	1	1	2	29,088
Total	--	1	6	7	NA
Total exploratory	--	1	12	13	NA
Development drilling:					
Cook Inlet Basin:					
Kenai	6	--	--	6	NA
Tyonek	--	1	--	1	NA
Total	6	1	--	7	NA
North Slope:					
Beechey Point	6	--	--	6	NA
Total development	12	1	--	13	NA
Grand total	12	2	12	26	[1] 246,000

NA Not available.

[1] Grand total of 246,200 feet from American Petroleum Institute data which did not show breakdown by well category.

Source: American Petroleum Institute.

Corp.'s No. 1 Kemik Unit in the Arctic Slope Basin, according to the Alaska Division of Oil and Gas. The average footage of 9,469 feet was down slightly from the 5-year average of 10,433 feet. However, exploratory footage drilled was up 52% over that of 1971, as reported by the Alaska Division of Oil and Gas.

METALS

Antimony.—There was no reported production of antimony in 1972. However, some exploratory work took place in the Kantishna, Fairbanks area, and the Forty Mile district.

Copper.—Only one mine in the McCarthy area reportedly produced 10 tons of copper ore. The ore was smelted at White Pine, Mich. This was because the smelter at Tacoma, Wash., which would normally handle the work, was operating on a restricted basis due to environmental pollution controls.

Exploration was pursued in Arctic Alaska where the Bear Creek Mining Co. drilled near Bornite in the Kobuk area. Eight miles to the north, at Arctic Camp, there was also some activity.

According to the Alaska Division of Geological and Geophysical Survey's Annual Report 1972, three prospect holes were drilled in the Alaskan interior by three different operators. Of the five other companies who reportedly maintained exploration field parties in the interior, two are major oil companies. In southcentral Alaska, four areas attracted enough interest to bring about prospect drilling. One of these was about a mile east of the Kennicott mine which closed in 1938. The other areas involved are at Cantwell, McCarthy, and the Peavine/Nelson/Radovan properties. In southeastern Alaska, eleven companies showed exploratory interest by drilling or maintaining offices. In the Ketchikan area, most of the drilling took place with reportedly six major diamond drilling prospects within a 100-mile radius of town.

Gold.—Conservatively, the volume of gold production in 1972 was estimated at about the same level as in 1971. Exploration activity also is reported to have slightly increased. Private assaying firms reported that their gold analyses were approximately double compared with those of 1971 although there was very little change in the number of gold placer operations. There was no known lode gold production in 1972. Exploration involved an evalulation of gold placer deposits by the American Smelting and Refining Company (Asarco). An offshore area south of Nome was evaluated by Asarco by drilling and bulk sampling.

Iron Ore.—Further development of the low-grade iron ore deposits at Klukwan by the Japanese-owned Iron Ore Co. of Alaska await the outcome of the H. J. Kaiser Co.-conducted mining feasibility study.

Lead.—Only one operator mined a total of 14 tons of silver-bearing lead ore. The mine is south of the Tanana River in the southern part of the Fairbanks quadrangle of central Alaska. Exploration work at the old Independence property on the Kugruk River was conducted by a miner, Rhinehart Berg. The objective of the exploration is a complex lead zinc-silver ore.

Mercury.—The only known mining operation was by R. Lyman, who continued the mining and concentrating of cinnabar ore at White Mountain southeast of McGrath in the Kuskokwim Valley about 200 miles northwest of Anchorage. There was no known exploratory work done in 1972, which may reflect the 20-year record low price for mercury of $152.50 per flask in April. Average price during 1972 was a low $218 per flask.

Platinum.—The Goodnews Bay Co. continued with its floating dredge operation on the Salmon River near Kuskokwim Bay in Southwest Alaska. Volume of production was about the same as in 1971. A midyear increase in the price of platinum may have caused platinum to be the number one precious metal produced in Alaska.

Silver.—Reportedly, the Phelps Dodge Corp. drilled a prospect on Coronation Island, west of Prince of Wales Island. In the same area, in Ketchikan, El Paso Natural Gas Co. maintained a geological staff. Eight other operators contributed to the exploratory effort.

NONMETALS

Barite.—The Alaska Barite Co., a subsidiary of Inlet Oil Co., continued mining its underwater open pit near Castle Island, about 12 miles southeast of Petersburg, Alaska. Exploratory drilling was undertaken to increase the reserves of barite and also to explore the barite-containing sulfide zone. The latter could extend the life of the mine by virtue of recovery of other valuable minerals in the area.

Fluorite.—The Lost River Mining Corp., Ltd., a subsidiary of Pan Central Exploration, Ltd., is continuing to upgrade facilities and complete a feasibility report concerning exploitation of the newly found multiple fluorite zones, up to seven, which were located in 1970 and 1971 by diamond drilling. The operation is in the area of the old Lost River tin mine located about 90 miles northwest of Nome, Alaska. In addition to fluorite, tin and tungsten have been found in the newly defined zones.

Sand and Gravel.—Production of sand and gravel decreased in volume by 40% in 1972 and in value by 54% from 1971 levels. In short tons, the production figures for 1971 and 1972 are 23,617,000 and 14,187,000, respectively.

A continued lower level of sand and gravel production is to be anticipated in view of the failure of the U.S. Congress to pass a highway bill in 1972. Therefore, no funds are set aside for highway construction beyond mid-1973. By the time funds could be made available, some of the major projects will probably not be started before the start of the freezup. On the brighter side, the North Slope access road for the pipeline should cause a marked improvement in the demand for sand and gravel when legal entanglements are cleared away.

Stone.—Likewise, production of stone decreased in volume by 75.5% and in value by 40.5% from 1971 levels. In short tons, the production figures for 1971 and 1972 are 2,658,000 and 652,000, respectively.

Table 10.—Oil production in Alaska by field

Year	Katalla field	Swanson River field	Middle Ground Shoal field	Trading Bay field	Granite Point field	McArthur River field	Prudhoe Bay field	Redoubt Shoal field	Total
Prior to 1968	154,000	74,951,420	10,080,139	730,407	7,053,731	753,984	--	--	93,723,681
1968	--	13,619,458	14,133,697	3,477,181	13,131,481	21,782,810	--	1,596	66,145,673
1969	--	13,150,877	10,467,090	9,935,605	9,183,291	31,300,978	277,377	--	74,315,218
1970	--	12,407,889	12,719,458	9,600,298	7,522,329	40,164,706	1,199,414	--	83,614,089
1971	--	11,466,356	11,303,651	8,743,637	5,577,411	40,536,998	1,156,812	--	78,784,865
1972	--	8,896,198	9,719,674	8,585,287	4,662,955	40,774,241	922,147	--	73,560,502
Cumulative production	154,000	134,492,198	68,423,709	41,072,410	47,131,148	175,313,217	3,555,750	1,596	470,144,028

Source: Alaska Division of Oil and Gas.

Table 11.—Alaska: Placer production of gold

Year	Mines producing	Material[1] treated (thousand cubic yards)	Gold recovered		
			Quantity (troy ounces)	Value (thousands)	Average value per cubic yard
1968	37	1,208	21,124	$829	$0.687
1969	30	1,081	21,146	878	.812
1970	23	999	34,776	1,265	1.266
1971	27	1,060	12,327	508	.480
1972	25	902	8,639	506	.561

[1] Excludes material treated primarily for the recovery of platinum.

Table 12.—Alaska: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	W	321	162	294
Fill	W	W	731	433
Paving	83	233	(1)	(1)
Other uses	494	877	(1)	(1)
Total[2]	578	1,431	893	726
Gravel:				
Building	147	299	199	436
Fill	1,791	722	1,800	841
Paving	575	996	991	1,841
Miscellaneous	W	W	50	W
Other uses[3]	528	874	318	338
Total[2]	3,040	2,891	3,358	3,457
Government-and-contractor operations:				
Sand:				
Building	20	58	1	(4)
Fill	31	40	8	4
Paving	5,749	8,561	2,865	2,827
Other uses	10	77	4	11
Total[2]	5,810	8,735	2,878	2,843
Gravel:				
Building	7	7	--	--
Fill	533	486	70	72
Paving	13,543	19,216	6,784	8,075
Other uses	106	41	205	41
Total[2]	14,188	19,750	7,058	8,188
Total sand and gravel[2]	23,617	32,806	14,187	15,214

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Included with fill sand to avoid disclosing individual company confidential data.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1972).

[4] Less than ½ unit.

Table 13.—Principal producers

Commodity and company	Address	Type of activity	Region
Barite:			
Alaska Barite Co	Anchorage, Alaska 99500	Open pit	Southeastern Alaska.
Coal:			
Usibelli Coal Mine, Inc	Usibelli, Alaska 99787	do	Yukon River.
Gold:			
U.S. Smelting Refining & Mining Co	Fairbanks, Alaska 99701	Dredge	Do.
L. McGee	Manley Hot Springs, Alaska 99756	Nonfloat Plant	Do.
Ruby Mining Co	Ruby, Alaska 99768	do	Do.
Prince Creek Mining Co	Flat, Alaska 99584	do	Do.
Natural Gas:			
Phillips Petroleum Co	Anchorage, Alaska 99500	Gas production	No. Cook Inlet field, Offshore Cook Inlet.
Standard Oil Co. of California	do	do	Beluga River gasfield, Westside Cook Inlet.
Texaco Inc	do	do	Nicolai Creek field, Westside Cook Inlet.
Union Oil Co. of California	do	do	Offshore Cook Inlet, Kenai Peninsula.
Petroleum-crude:			
Amoco Production Co	do	Oil production	Offshore Cook Inlet.
Atlantic Richfield Co.	do	do	Kenai Peninsula, Offshore Cook Inlet, North Slope.
BP Alaska, Inc	do	do	North Slope.
Mobil Oil Corp	do	do	Offshore Cook Inlet.
Shell Oil Co	do	do	Kenai Peninsula, Offshore Cook Inlet.
Texaco Inc	do	do	Offshort Cook Inlet.
Standard Oil Co. of California	do	do	Kenai Peninsula.
Union Oil Co. of California	do	do	Offshort Cook Inlet.
Petroleum refining:			
Atlantic Richfield Co	Prudhoe Bay, Alaska	Refinery	North Slope.
Standard Oil Co. of California	Nikiski, Alaska	do	Kenai Peninsula.
Tesoro-Alaskan Petroleum Corp	do	do	Do.
Union Oil Co. of California	Anchorage, Alaska 99500	Refinery (asphalt)	Anchorage.
Platinum-group metals: Goodnews Bay Mining Co.	Fairbanks, Alaska 99701	Dredge	Salmon River.
Sand and gravel:			
Anchorage Sand and Gravel Co	Anchorage, Alaska 99500	Stationary plant	Cook Inlet.
Central Construction Co., Inc	Seattle, Wash. 98100	Open pit	Northwestern.
Vast Construction Co., Inc	Anchorage, Alaska 99500	do	Cook Inlet.
Stone:			
Burgess Construction Co	Fairbanks, Alaska 99701	Open quarry	Various.
Central Construction Co., Inc	Seattle, Wash. 98100	do	Northwestern Alaska.
Herman Brothers Construction Co., Inc	Palmer, Alaska	do	Kenai Peninsula.
Moore Construction Co., Inc	Ketchikan, Alaska 99901	do	Do.
Walsh & Co., Inc	Anchorage, Alaska 99500	do	Cook Inlet.
Wayne Construction Co	Ketchikan, Alaska 99901	do	Southern Alaska.

The Mineral Industry of Arizona

This chapter was prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Arizona Bureau of Mines for collecting information on all minerals.

By Lyman Moore[1]

The value of mineral production in Arizona was $1,091 million, 11% above the 1971 value. Income from the mineral industry ranked second only to manufacturing which, with value added totaled $1,630 million. Metals accounted for 92% of the mineral output value, nonmetals 7%, and mineral fuels 1%. The value of metals produced increased 10% above that of 1971, nonmetals 25%, and mineral fuels 56%. Copper production was 908,612 tons, about 55% of domestic output. The value of copper production was $930 million, 85% of the total value of minerals produced. Molybdenum production, in which the State ranks second in the Nation, increased 20% to 27.2 million pounds, a record high. Arizona remained second in silver production with an output of 6.7 million troy ounces, and fourth in gold production with 102,996 troy ounces. Principal nonmetals produced were cement, sand and gravel, stone, and lime. The increase in mineral fuel output was due to increased coal production for electric power generation.

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[1] Mining engineer, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in Arizona[1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays[2] ......thousand short tons..	119	$84	134	$855
Coal (bituminous) ......do....	1,146	W	W	W
Copper (recoverable content of ores, etc.) ..short tons..	820,171	852,978	908,612	930,419
Gem stones	NA	160	NA	168
Gold (recoverable content of ores, etc.) troy ounces..	94,038	3,879	102,996	6,036
Iron ore (usable) ..thousand long tons, gross weight..	15,859	W	W	W
Lead (recoverable content of ores, etc.) ...short tons..	859	237	1,763	530
Lime ......thousand short tons..	296	4,474	356	6,024
Molybdenum (content of concentrates) thousand pounds..	22,684	39,872	27,216	46,791
Natural gas ......million cubic feet..	868	153	W	W
Petroleum (crude) ......thousand 42-gallon barrels..	1,236	3,918	993	3,226
Pumice ......thousand short tons..	949	625	915	722
Sand and gravel ......do....	19,791	24,391	24,842	32,420
Silver (recoverable content of ores, etc.) thousand troy ounces..	6,170	9,538	6,653	11,210
Stone ......thousand short tons..	2,873	5,848	4,638	8,018
Zinc (recoverable content of ores, etc.) ..short tons..	7,761	2,499	10,111	3,589
Value of items that cannot be disclosed: Asbestos, cement, fire clay, diatomite, feldspar, fluorspar, gypsum, helium, mica (scrap), perlite, pyrites, tungsten, and values indicated by the symbol W ...	XX	32,364	XX	41,496
Total	XX	981,020	XX	1,091,004
Total 1967 constant dollars	XX	834,161	XX	[p] 907,606

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes bentonite (1971) and fire clay (1972); included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Arizona, by county

(Thousands)

County	1971	1972	Minerals produced in 1972, in order of value
Apache	$5,918	$5,412	Petroleum, helium, clays, pumice, sand and gravel, natural gas, stone.
Cochise	62,799	56,957	Copper, stone, lime, sand and gravel, gold, silver.
Coconino	666	W	Pumice, sand and gravel, stone.
Gila	101,614	113,588	Copper, lime, stone, asbestos, sand and gravel, silver, fluorspar, gold, molybdenum, clays, lead.
Graham	W	W	Sand and gravel, stone, copper, pumice.
Greenlee	119,492	124,408	Copper, lime, silver, gold, stone, sand and gravel.
Maricopa	14,420	18,793	Sand and gravel, lime, stone, clays.
Mohave	34,017	37,357	Copper, molybdenum, sand and gravel, silver, feldspar, gold, stone.
Navajo	W	W	Coal, sand and gravel, iron ore, pumice, stone.
Pima	378,219	418,267	Copper, molybdenum, cement, silver, sand and gravel, stone, gold, lime, lead, clays, zinc, mica, tungsten.
Pinal	211,772	255,009	Copper, molybdenum, gold, silver, sand and gravel, lime, gypsum, stone, perlite, pyrites, diatomite, clays.
Santa Cruz	W	765	Zinc, sand and gravel, lead, stone, silver, copper.
Yavapai	46,284	48,352	Copper, cement, zinc, sand and gravel, molybdenum, stone, lime, silver, gypsum, lead, clays, gold, iron ore.
Yuma	W	W	Sand and gravel, stone.
Undistributed [1]	5,819	12,091	
Total [2]	981,020	1,091,004	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes some sand and gravel, and stone (1971) that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Arizona business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total nonagricultural employment .... thousands..	582.5	644.7	+10.7
Services and miscellaneous .... do....	99.9	111.9	+12.0
Trade .... do....	135.3	151.0	+11.6
Mining .... do....	20.6	22.2	+7.8
Construction .... do....	44.5	54.7	+22.9
Manufacturing .... do....	88.8	97.2	+9.5
Government .... do....	129.5	139.5	+7.7
All other .... do....	63.9	68.2	+6.7
Personal income:			
Total .... millions..	$7,278	$8,364	+14.9
Per capita	$3,913	$4,300	+9.9
Construction activity:			
New housing units authorized	49,116	57,369	+16.8
Value of nonresidential construction .... millions..	$196.5	$275.5	+40.2
Highway construction contracts awarded .... do....	$74.9	NA	--
Portland cement shipments to and within the State thousand short tons..	1,364	1,544	+13.2
Farm marketing receipts .... millions..	$769.9	$871.3	+13.2
Mineral production value .... do....	$981	$1,091	+11.2

[p] Preliminary. NA Not available.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; U.S. Bureau of Mines; and Division of Economic and Business Research, University of Arizona.

Table 4.—Major sources of income in Arizona[1]

(Thousands)

Source of income	1971	1972 [p]	Change, percent
Manufacturing (value added)	[r] $1,384,600	$1,630,000	+18
Mining [2]	981,000	1,091,000	+11
Tourism	600,000	650,000	+8
Livestock	[r] 415,005	479,986	+16
Crops	[r] 303,089	342,258	+13

[p] Preliminary. [r] Revised.

[1] Valley National Bank Research Department, Phoenix, Ariz., August 1973.

[2] U.S. Bureau of Mines.

Table 5.—Valuation on centrally assessed groups of property in Arizona[1]

(Thousands)

Group	1971	1972	Change, percent
Utilities	$1,380,943	$1,542,144	+12
Mines	793,602	912,300	+15
Pipelines	350,833	365,379	+4
Railroads	151,156	162,644	+8
Airlines	24,475	25,583	+5
Oil and gas	4,570	3,591	−21

[1] Pay Dirt. No. 396, June 26, 1972, p. 6.

Employment and Injuries.—Final Bureau of Mines statistics for 1971 and preliminary data for 1972 on employment and injuries in the mineral industries, excluding petroleum and natural gas, are given in table 6.

Legislation and Government Programs.—The Arizona State Department of Property Valuation reported that the value of Arizona's producing mines was $912 million, 15% more than the 1971 valuation. All of the large mines had sizable increases except the Morenci mine of Phelps Dodge Corp. and the Mineral Park mine of Duval Corp. The largest increases occurred at Pima Mining Co., $26 million, and at Kennecott Copper Corp.'s Ray Mine Division, $23 million. The Black Mesa mine of Peabody Coal Co. was placed on the tax rolls for the first time at a valuation of $9.5 million. The Morenci mine remained the State's most valuable property, although its valuation was reduced 8% to $158 million. The State tax rate was reduced to $1.55 per $100 of taxable valuation from the $1.90 levied in 1971. Mining properties are taxed by State, county, city, school district, and other taxing units at 60% of the value determined by the State Department of Property Valuation. Industrial facilities are taxed at 25% of value and agricultural operations at 15%. The average total tax rate throughout the State for all taxing units in 1972 was $11.36 per $100 taxable valuation and in 1971 was $11.58. Taxation of mining leaseholds on Indian land was ruled illegal by the Tucson Superior Court in December. An appeal is expected. Much of Arizona's mineral production comes from Indian land.

Federal and State agencies continued to develop and implement programs to reduce atmospheric pollution. The Air Pollution Control Division of the Arizona

Table 6.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-fatal	Frequency	Severity
1971:								
Coal	98	276	27	215	--	19	88.26	NA
Metal	12,210	320	3,903	31,243	11	807	26.18	3,001
Nonmetal	284	214	61	490	1	21	44.94	13,220
Sand and gravel	1,342	243	326	2,712	1	69	25.82	3,123
Stone	489	304	148	1,191	--	26	21.83	459
Total	14,423	310	4,465	[1] 35,850	13	942	26.64	NA
1972:[2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	12,035	329	3,963	31,729	6	810	25.72	1,984
Nonmetal	145	150	21	171	--	5	29.20	578
Sand and gravel	1,005	230	232	1,873	3	55	30.97	10,481
Stone	425	309	132	1,061	1	20	19.80	6,289
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data do not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

Board of Health, after extensive study and public hearings, published on May 25 revised standards for sulfur emissions from smelters to implement the Federal Clean Air Act of 1970. The new standards required that by January 1974 the annual average sulfur dioxide content of air surrounding smelters be less than 80 micrograms per cubic meter and by July 1975 less than 50 micrograms per cubic meter. Higher concentrations were allowed for short periods. The new standards were similar to ones adopted in 1970 except that they did not require that at least 90% of the sulfur contained in the feed be removed from the plant emissions. Smelter operations would be allowed to maintain acceptable air quality surrounding the smelter by production curtailments during periods of atmospheric stagnation. However, the revised standards did provide that new smelters, and after 1980 all smelters, must remove at least 90% of the feed sulfur from the atmospheric exhaust.

The Administrator of the Environmental Protection Agency (EPA) refused, in a decision announced May 31, to approve the smelter emission standards adopted by the Arizona Board of Health, as well as similar standards adopted by other States. EPA held that the intermittent production curtailment method of controlling sulfur dioxide concentrations as proposed in State standards was inadequate and unenforceable, and that smelter sulfur emissions should be limited to a small enough proportion of the sulfur in the feed to insure that atmospheric pollution would not occur. EPA also announced that it would propose methods and standards for sulfur control that, after public hearings and further consideration, would be adopted for promulgation in Arizona. The standards would set a maximum proportion of feed sulfur that each smelter could emit based on EPA records of sulfur dioxide concentrations in the air surrounding that smelter.

EPA published its standards on July 27, and public hearings were held in September; comments were received until mid-October. The proposed standards provided that by July 31, 1975, smelter operators will install sulfur dioxide controls, which are reasonably available, on roasters, converters, and sintering machines. Controls would include sulfuric acid or other sulfur-recovery plants, and equipment to conduct all emissions to the plants. The Federal primary air standard of 80 micrograms per cubic meter was to be met by July 31, 1975; however, the proposal provides a 2-year extension until July 31, 1977, if compliance will require control technology that Smelters may use temporary production is not reasonably available at present. curtailments during the 2-year extension period, but must apply permanent controls by July 1977 to achieve full compliance with national standards. The permanent controls will use advanced methods to limit sulfur emissions to a small enough proportion of the sulfur in the feed to insure that air surrounding smelters will always meet primary standards. This will require removal of from 69% to 97% of the feed sulfur at Arizona smelters. Powerplant operators would be required to remove 70% of the sulfur contained in the fuel, from plant exhausts by July 31, 1977.

The Arizona Board of Health, smelter operators, and power companies separately petitioned Federal courts during August for judicial review of the EPA disapproval of the State air standards. Arizona contended in its petition that the Clean Air Act of 1970 gave State and local Governments primary responsibility for atmospheric pollution control; that sulfur dioxide control by intermittent production limitations is acceptable because the Clean Air Act refers to it as an allowable method; and that the Arizona plan fully meets requirements of the Clean Air Act whereas the EPA proposal does not within the capacity of present technology and the recommended time limit of 3 years. EPA holds that intermittent production curtailments should not be used to meet annual air quality standards, although necessary to meet 24-hour and 3-hour standards. Arizona also challenged the accuracy of some data used by EPA for setting specific sulfur removal requirements. In February 1973 the Federal court agreed to review the EPA rejection of the State plan. The Federal court had rejected the smelter operators and power company petitions on November 22. Defense attorneys argued that a court review would be premature until a ruling was made on the State petition and until pollution standards had been promulgated.

At the end of 1972 all Arizona smelters had conditional operating permits continuing until January 1974, and all operators were constructing new facilities or were installing pollution abatement equipment considered adequate to reduce sulfur emissions to the primary standard of 80 micrograms per cubic meter by 1974. The status of operating and partially constructed sulfur removal facilities at Arizona smelters at yearend 1972 was as follows: At the Douglas facility, new emission collecting equipment being installed would allow the smelter to operate at 58% capacity. Only short-term pollution control expenditures are economically justifiable at this 65-year-old plant. Morenci facilities installed or under construction should recover 70% of the sulfur. Ajo facilities under construction should recover 90% of the sulfur. Hayden (Kennecott Copper Corp.) facilities installed or under construction should recover 90% of the sulfur. Hayden (American Smelting and Refining Company) facilities now operating recover 55% of the sulfur, and a higher stack was being built and a new sulfur dioxide monitoring network was being installed. Inspiration facilities under construction should recover over 90% of the sulfur. San Manuel facilities under construction should recover 70% of the sulfur. Sulfur removal equipment at the coal burning Mohave, Nev., powerplant removed 90% of contained sulfur during test runs; however, excessive deposition of sulfates in the scrubbers remains a problem.

Enabling legislation was passed by the State allowing local governmental agencies to financially assist private pollution abatement programs, thus allowing pollution control to be financed by tax-exempt loans. However, pollution facilities installed will be taxed by local and State jurisdictions on exactly the same basis as existing production facilities. The first loan granted under this act was for $30 million from the Industrial Authority of Pinal County to Newmont Mining Corp. for pollution control to be installed at the San Manuel smelter. The constitutionality of the enabling law was questioned but was upheld in a May 1973 ruling of the Arizona Supreme Court.

Bureau of Mines engineers are studying ground breakage and movement during undercut stoping to obtain information for developing more efficient mining methods. Data are being collected in a test block-caving stope, being mined by Phelps Dodge Corp., to determine mining characteristics of the Safford ore deposit. Advanced measuring instruments are used to record ground movement resulting from the stoping. Bureau engineers also studied blasting techniques to break ore bodies for in situ leaching. Test blasts were made using various drill hole spacings in an Arizona porphyry copper deposit. Core drilling was used to obtain samples of rock before and after blasting for fragmentation evaluations.

Bureau metallurgists are studying methods for recovering copper from screened Arizona mine waste. The higher grade fine fraction is considered a promising source of concentration or vat leaching feed. The coarse material yields a higher copper recovery by dump leaching than unscreened waste, because circulation impeding fines have been removed. Metallurgical research was also done on agitation leaching of copper silicate ores. Studies continued on tailings dam stabilization and on prevention of surface water pollution from drainage of tailings impoundments and waste dumps.

The U.S. Geological Survey and the Bureau of Mines studied the mineral potential of the proposed Chiricahua Wilderness Area in Cochise County and the Galiuro Wilderness Area in Graham County.

REVIEW BY MINERAL COMMODITIES

METALS

Copper production continued to dominate Arizona metal mining activity. Thirty-three mines produced copper ore or silicious fluxing material containing low values in gold, silver, and copper. Copper-zinc ore was produced at one mine, lead-zinc ore at one mine, iron at one mine, and tungsten ore at one mine.

Copper.—Arizona mines produced 908,612 tons of copper, 11% more than in 1971 (when strikes idled most plants for 1 to 2 months) and only 1% below the record 1970 production. Thirty-three mines reported copper production. Of these, 16 mined principally concentrating ore, 5 leaching ore, 3 both concentrating and leaching ore, 5 direct smelting ore, and 4 low-grade silicious fluxing ore. Tailings containing copper were shipped from one property for flux. Cleanup material was shipped to smelters from five mines or plants. Of the total copper production 783,918 tons was recovered from 153.09 million tons of ore treated by concentration, 57,482 tons from 12.45 million tons of ore treated by vat or heap leaching, 60,380 tons from dump leaching, and 6,832 tons from direct smelting ore and fluxes. About 21% of the total copper production was from underground mines. The average copper yield from concentrating open pit ores was 9.1 pounds per ton of ore, and from associated dump leaching was equivalent to 0.6 pound per ton of concentrating ore. The average yield from vat leaching open pit ore was 13.5 pounds per ton. The average yield from heap leaching ore was 4.3 pounds of copper per ton of ore placed on leach heaps. The average yield from underground ore concentrated was 15.7 pounds per ton and of associated underground leaching was equivalent to 0.5 pound per ton of concentrating ore mined.

The Morenci plant of the Phelps Dodge Corp. mined 17,215,000 tons of ore in 1972 and recovered 119,763 tons of copper including 12,247 tons from leach dumps, compared with 16,590,000 tons of ore produced the previous year and 113,598 tons of copper recovered including 7,090 tons from leach dumps. Waste stripping declined to 33,013,000 tons from 36,347,000 tons in 1971.[2] The mine and concentrator were operated on a 6-workday-per-week schedule throughout the year. The Morenci smelter treated the output of both the Morenci and Tyrone, N. Mex., mines; production approached 200,000 tons. Facilities and equipment to remove sulfur dioxide from smelter exhausts are being installed at a total cost of $85 million, of which $17,071,000 was expended during 1972. These facilities include a new 2,000-ton-per-day sulfuric acid plant, acid storage facilities, a new reverberatory furnace, waste-heat boilers, electro-

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[2] Phelps Dodge Corp. 1972 Annual Report. P. 9.

Table 7.—Arizona: Total value of mineral production in Arizona, and production and value of copper in Arizona and the United States

Year	Arizona			United States		Arizona	
	Total value mineral production (thousands)	Copper production		Copper production		Percent of U.S. copper production	Percent of world copper production
		Quantity (short tons)	Value (thousands)	Quantity (short tons)	Value (thousands)		
1968	$617,541	627,961	$525,566	1,204,621	$1,008,195	52.1	11.1
1969	859,462	801,363	761,840	1,544,579	1,468,400	51.9	12.9
1970	1,166,767	917,918	1,059,277	1,719,657	1,984,484	53.4	13.8
1971	981,020	820,171	852,978	1,522,183	1,583,071	53.9	12.3
1972	1,091,004	908,612	930,419	1,664,840	1,704,796	54.6	12.4

Table 8.—Arizona: Fifteen leading copper-producing mines, in order of output

Rank in 1972	Rank in 1971	Mine	County	Operator	Source of copper in 1972
1	2	San Manuel	Pinal	Magma Copper Co	Copper ore.
2	1	Morenci	Greenlee	Phelps Dodge Corp	Copper ore and copper precipitates.
3	3	Ray	Pinal	Kennecott Copper Corp	Do.
4	4	Pima	Pima	Pima Mining Co	Copper ore.
5	7	Twin Buttes	do	The Anaconda Company	Do.
6	5	Sierrita	do	Duval Sierrita Corp	Do.
7	6	New Cornelia	do	Phelps Dodge Corp	Copper and gold-silver ores.
8	8	Inspiration	Gila	Inspiration Consolidated Copper Co.	Copper ore and copper precipitates.
9	9	Mission	Pima	American Smelting and Refining Company.	Copper ore.
10	10	Copper Queen	Cochise	Phelps Dodge Corp	Do.
11	13	Mineral Park	Mohave	Duval Corp	Copper ore and copper precipitates.
12	12	Copper Cities	Gila	Cities Service Co	Do.
13	14	Silver Bell	Pima	American Smelting and Refining Company.	Do.
14	11	Lavender Pit	Cochise	Phelps Dodge Corp	Do.
15	16	Bagdad	Yavapai	Bagdad Copper Corp	Copper ore.

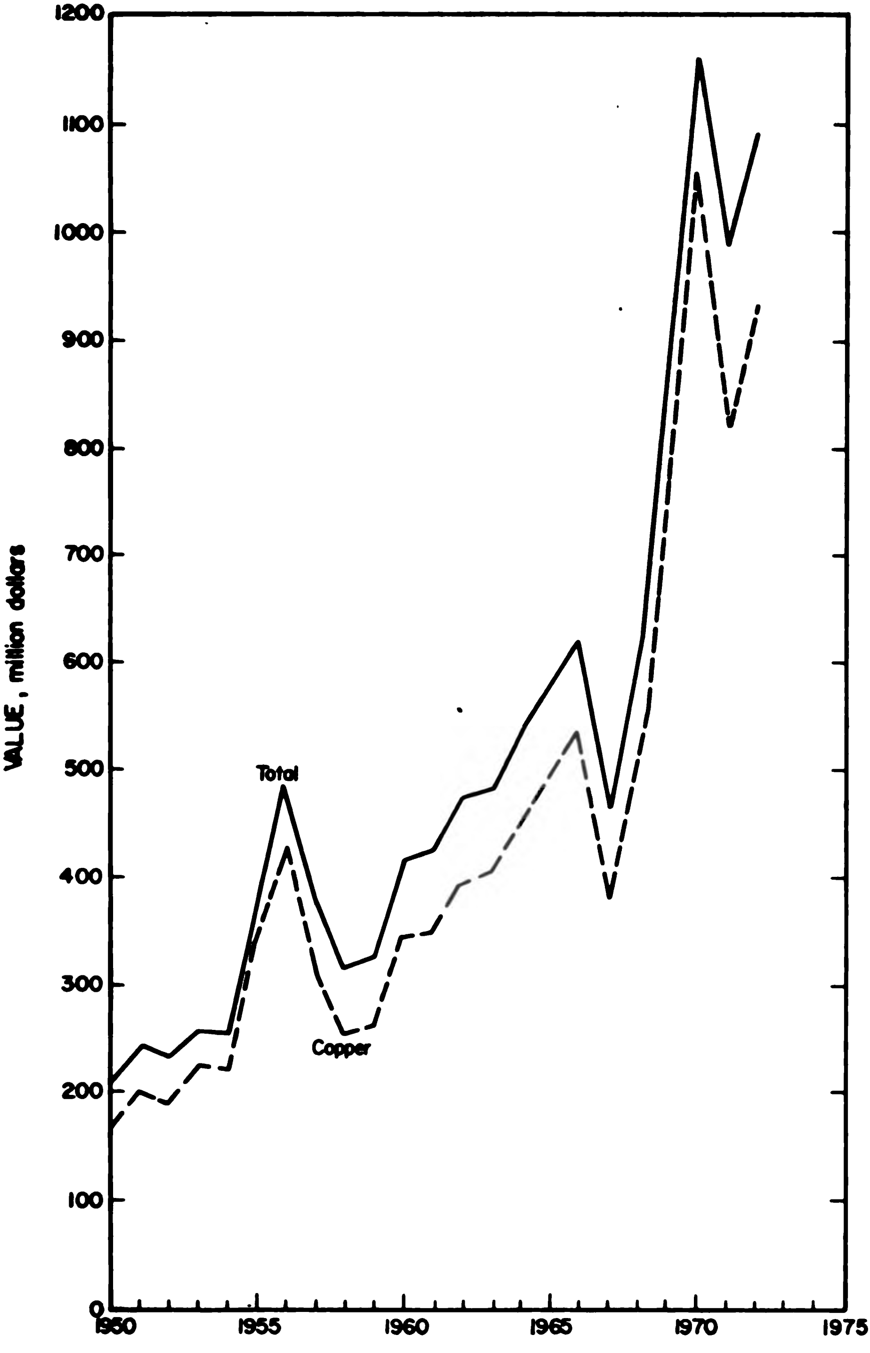

Figure 1.—Value of mine production of copper and total value of mineral production in Arizona.

Table 9.—Arizona: Ore mined, waste material removed, leach material placed in dumps, and total copper production at principal copper open pit and underground mines

Mine	Ore mined (thousand short tons)		Waste material removed[1] (thousand short tons)		Leach material placed in dumps (thousand short tons)		Total copper produced from all sources[2] (short tons)	
	1971	1972	1971	1972	1971	1972	1971	1972
OPEN PIT								
Morenci	16,590	17,215	24,782	19,575	11,565	13,438	116,833	123,176
Ray	13,396	9,754	--	--	23,243	26,600	89,388	87,064
Pima	14,617	15,609	[3]15,288	[3]14,529	--	--	68,073	82,841
Twin Buttes	7,666	13,661	78,416	98,763	--	--	53,331	79,122
Sierrita	25,727	28,351	46,568	35,614	--	13,151	63,049	68,940
New Cornelia	9,244	9,792	13,198	13,518	--	--	53,616	58,656
Inspiration	6,856	7,792	6,569	9,345	5,245	4,987	[4]45,273	[4]53,986
Mission	6,725	8,364	20,029	25,506	--	--	40,618	45,371
Mineral Park	5,645	7,050	2,944	3,140	4,713	2,562	25,405	26,559
Copper Cities	4,550	5,053	2,208	123	6,819	5,461	25,459	24,401
Silver Bell	3,796	3,840	8,098	7,406	1,880	2,200	23,046	23,560
Lavender Pit	4,575	3,761	742	--	6,645	1,799	26,590	22,315
Bagdad	2,001	1,982	5,590	8,213	3,139	2,153	20,085	19,263
UNDERGROUND								
San Manuel	14,909	21,845	184	310	--	--	94,217	135,751
Copper Queen	768	643	--	--	--	--	30,985	27,957

[1] Excludes leach material.
[2] Gross metal content.
[3] Thousand cubic yards.
[4] Recoverable content.

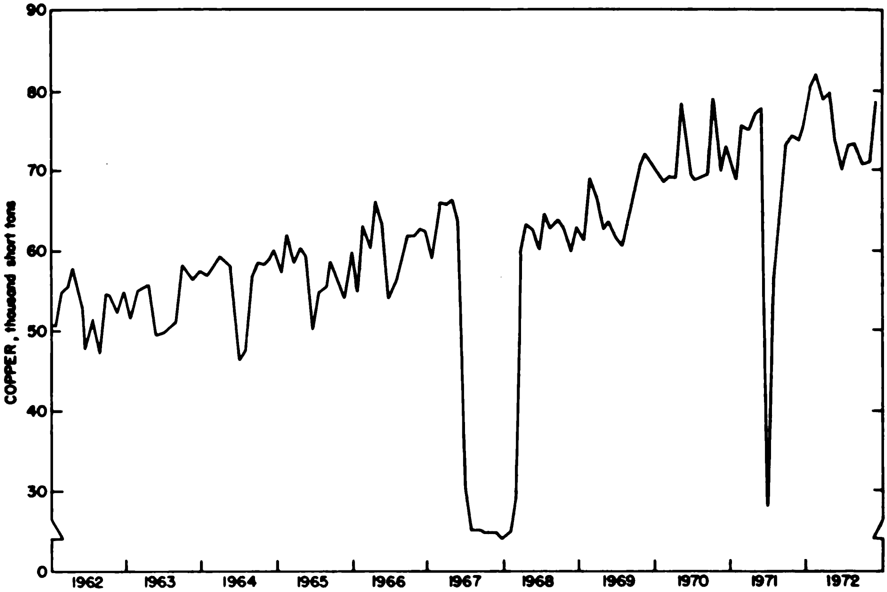

Figure 2.—Mine production of copper in Arizona, by month, in terms of recoverable metal.

static precipitators, a new converter furnace, and new hoods, gas coolers, and scrubbers for all converters. The highest average yearly sulfur dioxide concentration recorded during the past year at a distance of about 2½ miles from the smelter was 102 micrograms per cubic meter. The new acid plant and the existing 500-ton-per-day plant will capture about 70% of the sulfur contained in the smelter feed and will reduce annual average emissions to below the primary standard. A closed-loop system will be used to prevent high-term concentrations due to unfavorable weather conditions.

Table 10.—Arizona: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing[1]		Material sold or treated (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1970, total	82	--	[r]150,636,261	109,853	$3,997,547	7,330,417	$12,980,850
1971, total	50	--	[r]149,550,585	94,038	3,879,070	6,169,623	9,538,238
1972:							
Cochise	2	--	4,410,632	24,686	1,446,600	567,183	955,704
Gila	8	--	21,706,719	6,084	356,523	295,731	498,308
Greenlee	1	--	17,231,107	12,472	730,860	511,405	861,717
Pima	9	1	79,785,322	26,031	1,525,419	3,556,507	5,992,714
Pinal	7	--	32,902,060	33,040	1,936,144	1,132,985	1,909,080
Yavapai	7	--	2,832,579	359	21,038	115,080	193,910
Undistributed[2]	5	--	7,242,835	324	18,986	473,909	798,537
Total[3]	39	1	166,111,254	102,996	6,035,570	6,652,800	11,209,970

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1970, total	917,918	$1,059,276,806	285	$88,950	9,618	$2,946,762	$1,079,290,914
1971, total	820,171	852,977,580	859	236,974	7,761	2,499,139	869,131,001
1972:							
Cochise	47,256	48,389,751	--	--	--	--	50,792,055
Gila	106,787	109,349,439	(4)	42	--	--	110,204,312
Greenlee	118,249	121,086,995	--	--	--	--	122,679,572
Pima	349,588	357,978,284	1,049	315,479	39	14,071	365,825,967
Pinal	233,565	239,170,257	--	--	--	--	243,015,481
Yavapai	25,221	25,826,061	284	85,495	9,293	3,298,972	29,425,476
Undistributed[2]	27,947	28,618,085	429	129,067	779	276,404	29,841,079
Total[3]	908,612	930,418,872	1,763	530,083	10,111	3,589,447	951,783,942

[r] Revised.

[1] Operations at miscellaneous cleanups not counted as mines.

[2] Includes Graham, Mohave and Santa Cruz Counties, combined to avoid disclosure of individual company confidential data.

[3] Data may not add to totals shown because of independent rounding.

[4] Less than ½ unit.

Table 11.—Arizona: Mine production of gold, silver, copper, lead, and zinc in 1972, by class of ore or other source material, in terms of recoverable metal

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Gold-silver	1	19,500	43	517	93	--	--
Silver	2	10,785	1	6,562	1	--	--
Total	3	30,285	44	7,079	94	--	--
Copper, copper-zinc, lead-zinc[2]	32	165,914,825	102,526	6,614,957	847,929	1,763	10,111
Other lode material:							
Gold-silver tailings	1	83,493	418	29,890	119	--	--
Copper cleanup	(3)	527	2	874	90	(4)	--
Copper precipitates	11	82,124	--	--	60,380	--	--
Total	12	166,144	420	30,764	60,589	--	--
Placer	1	--	6	--	--	--	--
Grand total	40	166,111,254	102,996	6,652,800	908,612	1,763	10,111

[1] Detail will not necessarily add to totals because some mines produce more than one class of material.

[2] Combined to avoid disclosing individual company confidential data.

[3] From properties not classed as mines.

[4] Less than ½ unit.

Table 12.—Arizona: Mine production of gold, silver, copper, lead, and zinc in 1972, by type of material processed and method of recovery, in terms of recoverable metal

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Acid leaching (vat, tank, heap)[1]	--	--	57,482	--	--
Smelting of concentrates	100,386	6,507,572	783,918	1,768	10,111
Direct smelting of—					
Cleanup	2	874	90	--	--
Ore	2,184	114,464	6,623	--	--
Precipitates[2]	--	--	60,380	--	--
Tailings	418	29,890	119	--	--
Total	2,604	145,228	67,212	--	--
Placer	6	--	--	--	--
Grand total	102,996	6,652,800	908,612	1,768	10,111

[1] Includes copper recovered by electrowinning process and cementation from ore.
[2] Production from leach dumps and waste dumps.

Production at the Ajo smelter and New Cornelia mine was 57,876 tons of copper compared with 53,000 tons in 1971. Ore production was 9,792,000 tons compared with 9,244,000 tons the previous year. Waste stripped was 18,518,000 tons compared with 18,198,000 tons in 1971. As at Morenci, the mine and concentrator were operated 6 days per week throughout the year. Facilities to remove sulfur dioxide from smelter fumes were also being constructed at Ajo. The estimated cost is $28 million, of which $14.8 million was spent in 1972. A new sulfuric acid plant of 600-ton-per-day capacity was completed late in the year. The acid plant contains a dimethylaniline section, which can effectively extract sulfur dioxide from the low-concentration fumes of reverberatory furnaces. This is one of the first plants and is the first large plant to use this process. Also being installed were new flues and waste heat boilers on the converter and reverberatory furnaces and new electrostatic precipitators. The new plant was expected to recover 90% of the sulfur in the smelter charge.

The Douglas smelter recovered about 135,000 tons of copper. The material treated included concentrates and precipitates from the Lavender pit, Copper Queen mine, and custom shippers, and some purchased scrap. Late in 1972, Phelps Dodge and the Arizona Air Pollution Board agreed on a proposal for control of sulfur dioxide emissions from Douglas, and a 1-year operating permit was issued to provide time for placing the plan in operation. The plan requires that hoods or other control devices be installed on all low-level sources of sulfur dioxide and dust emissions and that these be channeled to the stack. Smelter input of sulfur would be cutback an average of 42% to insure meeting average annual primary air standards and a closed-loop system used to regulate input as necessary to prevent exceeding short-term concentration limits. Cost is estimated at $15 million. The extent that production should be reduced to meet average annual standards was disputed. Observations and calculations made by Phelps Dodge showed that a 27% average reduction in input would have met primary standards in the previous year.

The Lavender pit at Bisbee produced 3,761,000 tons of ore containing 21,632 tons of recoverable copper, compared with 4,575,000 tons of ore and 24,017 tons of copper in 1971. About 23% of the copper was produced by dump leaching. Waste stripping decreased to 1,799,000 tons from 7,387,000 tons the previous year. The mine and concentrator were operated 5½ days per week during the year. The Lavender ore body is approaching depletion with exhaustion of presently economic ore expected in late 1973.

The Copper Queen underground mine at Bisbee produced 643,000 tons of ore containing 26,899 tons of recoverable copper, compared with the 1971 output of 768,000 tons of ore and 29,003 tons of metal. The mine was operated 5 days per week. Ore is concentrated at the Lavender plant. Copper precipitate production is included with that of the Lavender pit. Future viability of the Copper Queen is threatened by the closure of the Lavender pit, which will result in higher unit concentrating and general overhead costs.

Development and construction of the new

Metcalf mine and concentrator continued; however, the schedule was purposely advanced to avoid overcrowding the area living accommodations, already strained by the large construction program in progress at the nearby Morenci smelter. Completion is now expected in January 1975. The open pit mine and concentrator being constructed will have a capacity of 30,000 tons per day of ore and a yearly output of 50,000 tons of recoverable copper. Total cost is estimated by Phelps Dodge at $180 million, of which $19 million was expended in 1972. Ore reserves suitable for open pit mining are estimated to be 220,000,000 tons containing 0.74% copper. This reserve is underlain by 126,000,000 tons of ore containing 0.92% copper that would probably be mined by underground methods.

Mining tests continued at Stafford where a test block-caving stope is being mined to determine difficulty and cost. Results are expected by mid-1973. The Phelps Dodge Safford deposit contains an estimated 250,000,000 tons of ore grading 0.92% copper.

Magma Copper Co. (wholly owned by Newmont Mining Corp.) produced 21,844,943 tons of ore containing 135,751 tons of recoverable copper from the San Manuel Division and 450,573 tons of ore containing 18,169 tons of recoverable copper from the Superior Division.[3] Refinery production totaled 149,500 tons of electrolytic copper.[4] The 6-year program to increase annual production capacity from 120,000 tons of blister to 184,000 tons of electrolytic copper by 1974 continued on schedule. Mining and ore concentrating at San Manuel reached the planned 65,000-ton-per-day rate. New facilities at the Superior mine designed to double annual capacity to 40,000 tons of copper should be completed by late 1973. Enlargement of the Superior concentrator was completed in the fall of 1972. Smelter throughput was somewhat below expectations because of failure of converter hoods and unsatisfactory operation of a new automatic anode casting wheel. New converter hoods are being designed and installed and alterations are being made on the casting wheel.

Engineering and design were begun in June for a sulfuric acid plant of 2,000-ton-per-day capacity to utilize sulfur dioxide fumes from the converters. Completion is expected by March 1974. The acid plant is expected to recover about 70% of the sulfur contained in the feed and will in conjunction with a closed-loop monitoring system, allow atmospheric sulfur dioxide concentrations to be kept within primary standards. An alkaline scrubbing system may be installed later to remove sulfur from reverberatory exhausts. Financing of the pollution control equipment was done through a $30 million loan from the Pinal County Industrial Development Authority.

The Ray Mines Division of Kennecott Copper Corp. mined 10,364,150 tons of ore and produced 90,174 tons of copper.[5] Metal production was 8% above 1971 when operations were closed 1 month by a strike. Smelter throughput during 1971 was somewhat reduced by sulfur dioxide pollution restrictions with the result that concentrate inventories increased, necessitating a temporary reduction in mining and concentrating schedules to 6 days per week. Concentrate stocks had been lowered by late 1972 and 7-day-per-week mining and concentrating operations were resumed.

In September construction was begun on enlarging the sulfuric acid plant at the Hayden smelter from the existing 400-ton-per-day capacity single-contact system to a 900-ton-per-day double-contact system. Smelter modifications were also begun to more efficiently collect converter exhausts for acid plant use. Closed water cooled hoods are to be installed on converters and a water-spray gas cooling tower built for each converter. A regional computerized air quality monitoring system for closed-loop control is also being built in partnership with the American Smelting and Refining Company's Hayden smelter. When completed in late 1973 these installations were to allow sulfur dioxide concentrations to be kept below primary standards.

At the Ray mine a 165-foot-high flood-control dam and 3.6-mile diversion tunnel of 16-foot diameter were nearly completed. This installation will protect the open pit from flash flooding by Mineral Creek. Tests were begun of in situ leaching of mineralized diabase below the open pit using drill holes for solution circulation.

Pima Mining Co. produced 18,698,000 tons of ore with an average copper content of 0.525%. Concentrates were recovered having a gross copper content of 79,500 tons.[6] Ore production increased 28% and copper production 23% from that of 1971. A new section was added to the concentrator in early 1972 and is now treating about 17,000 tons per day, increasing total mill capacity to about 57,000 tons per day. The new section contains a primary crusher, a stacker, two 28-foot by 12-foot semiautogenous mills, two 14-½-foot by 19-foot ball mills, large flotation cells, a thickener, and a water reclaiming system. The semiautogenous mills replace the cone crushers and rod mills used in older circuits at the plant. Cost of the expansions was about $17 million. Studies are continuing to determine the feasibility of mining large ore extensions on the east and south boundaries of the mine. Developed ore reserves in 1972 were estimated at 240,000,000 tons grading 0.5% copper. The extensions, according to the company's annual report, could contain a similar quantity of ore having an unspecified grade. Several new models of haulage vehicles were tested in the pit, including a 250-ton capacity electric-wheel truck.

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[3] Arizona Department of Mineral Resources. The Copper Industry, Phoenix, Ariz. December 1973, pp. 1–42.

[4] Newmont Mining Corp. 1972 Annual Report. 32 pp.

[5] Kennecott Copper Corp. 1972 Annual Report. P. 24.

The Bruce mine division of Cyprus Mines Corp. produced 96,211 tons of ore containing 3.92% copper and 13.7% zinc. Metal production was 3,400 tons of copper in concentrate and 10,600 tons of zinc in concentrate.[7] Tonnage of ore mined was only 1% above that mined in 1971, but higher ore grades and better metallurgical recoveries resulted in copper and zinc outputs increasing 10% and 20%, respectively. The production shaft was deepened to a total depth of 2,320 feet and a decline haulageway driven to a 95-foot-lower elevation. A block of excellent grade ore was developed between the 2,150- and 2,300-foot levels.

On October 12 construction was begun on a pilot hydrometallurgical concentrate treatment plant of 50-ton-per-day feed capacity costing an estimated $9 million. The plant was designed to test the Cymet process. The process was developed by Cyprus Mines, Paul R. Kruesi, and Hazen Research Inc. The process uses ferric chloride solution and hydrochloric acid as solvents and uses high-density current to precipitate a metallic slurry containing over 90% copper, with the remainder being various metals. The slurry is collected and refined to electrolytic copper with gold, silver, and other byproducts being recovered in subsequent steps. High-quality iron is recovered from the cathode cell solution by electrolysis. Underflow from the leach solution thickener is filtered and heated to melt and agglomerate sulfur, which is screened off. The screen undersize is treated by flotation to make a concentrate, which is reprocessed. The remainder is a final tailing.

American Smelting and Refining Company (Asarco) produced 69,547 tons of copper from Arizona mines during 1972. This was 8% above the strike reduced 1971 output but 2% below the 1970 total. Production at Mission was 8,363,800 tons of ore and 45,371 tons of copper, increases of 24% and 12%, respectively, from 1971 production. Waste stripping increased 27% to 25,506,000 tons. Production at Silver Bell was 3,839,600 tons of ore and 23,560 tons of copper—including 3,948 tons from leaching—increases of 1% and 5%, respectively, from 1971 production. Waste stripping decreased 4% to 9,606,000 tons.

About 615 tons of copper was recovered from 75,580 tons of fluxing ore produced at the San Xavier mine on Papago Indian land, compared with 500 tons in 1971 from 68,200 tons of flux.[8]

Smelting operations at Hayden were slowed from May to August by failure of two of three compressors supplying air to the converters. A reduction averaging about 16% in quantity of concentrates treated was also necessary to maintain acceptable atmospheric sulfur dioxide concentrations. Current construction of a 1,000-foot-high stack and installation of an improved air quality monitoring network will allow air quality standards to be met with much smaller production curtailments. Construction was begun on new fire refining and casting facilities with completion expected in the spring of 1973. These will further process blister cake, the present smelter product, to fire refined anodes.

Construction of the San Xavier open pit mine and vat leaching plant was begun and nearly completed. At the mine, daily output was 4,000 tons of ore and 14,000 tons of waste. The vat leaching plant, at the Mission property 2.3 miles from the mine, will crush the ore to minus ⅜ inch, leach in vats with sulfuric acid from the Hayden acid plant, and precipitate the copper from solution by cementation. Daily production is expected to be about 33 tons of 82% copper precipitate.

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[6] Cyprus Mines Corp. 1972 Annual Report. P. 6.

[7] Work cited in footnote 6.

[8] Work cited in footnote 3.

Construction of the Sacaton mine and concentrator was started in June, and completion is scheduled for early 1974. Metal production will be 21,000 tons per year of copper from a daily output of 9,000 tons of ore. About 36,000 tons of waste will be moved daily during mining and 45 million tons of overburden will be stripped prior to ore production. Construction cost is estimated at $35 million.

Duval Corp., a subsidiary of Pennzoil Co., owns three open pit mines in Arizona. Two of these, Mineral Park and Sierrita, were operated throughout the year, the other, Esperanza, was closed from December 31, 1971, to January 15, 1973, to allow liquidation of excessive concentrate inventories accumulated when custom smelters were closed by strikes in 1971. Mineral Park produced 7,050,000 tons of ore and 26,559 tons of copper in concentrates and precipitates, of which 4,468 tons was from dump leaching. Ore production increased 25% and copper production 5% from 1971. Sierrita produced 28,351,000 tons of ore and 68,940 tons of copper in concentrates, an increase of 10% in ore and 9% in copper from the previous year. Production at Esperanza consisted entirely of 97 tons of copper from dump leaching.[9] The program to gradually increase production capacity at Sierrita to 84,000 tons per day was completed, and during November and December, the concentrator treated an average of 84,600 tons of ore daily. The shutdown at Esperanza was prolonged because throughput at the Asarco custom smelter at Hayden was reduced much of the year by damage to main compressors and by input restrictions needed to meet air quality standards. About 36,000 tons of concentrate was exported to Japan and West Germany

A 2-year pilot plant test of the proprietary "CLEAR" hydrometallurgical method for treating copper concentrates was successfully completed and construction was authorized for a commercial plant with a capacity of 32,500 tons of copper per year. The plant will be built on the Sierrita property and will cost an estimated $22 million. The process requires dissolving the copper minerals in acids, precipitation of copper by electrolysis; removal of byproduct sulfur, iron, and precious metals; and regeneration of the acid solution.

Inspiration Consolidated Copper Co. plants in the Inspiration, Christmas, and Ox Hide areas produced 70,079 tons of copper, an increase of 25% from production in the previous year. Inspiration area mines and plants produced 7,792,282 tons of ore and 50,746 tons of copper, of which 9,589 tons was produced by heap and dump leaching. Waste stripping totaled 14,332,000 tons. New primary and tertiary crushing units were installed. Long startup and break-in periods needed at the crushers resulted in reduced ore production during the second half of the year. Development of the Willow Springs heap leaching unit was continuing with completion expected in 1974. This operation will produce an estimated 5,000 tons of copper per year from low-grade ore mined at the Barney and Red Hill pits. Abundant sulfuric acid for leaching will become available with completion of the new smelter and acid plant.

The Christmas Division produced 1,973,853 tons of ore and 11,244 tons of copper. A total of 9,139,060 tons of waste was stripped. Higher grade ore was mined in 1972 than in 1971 and 11.4 pounds of copper was recovered per ton of ore treated compared with 9.9 the previous year. Experiments by operating and research personnel developed a promising method to increase the recovery of oxide copper in the concentrator.

The Ox Hide open pit mine and heap leaching operation produced 2,400,230 tons of ore and 4,475 tons of copper. Waste stripping totaled 1,061,995 tons. Metal production was 9% less than in 1971 because of extremely heavy rainfall in October and November that forced production curtailments.

Exploration continued on a mineralized area between the Live Oak and Ox Hide mines where both near-surface and deep-lying ore zones have been discovered. About 55,000 feet of hole has been drilled.

A preliminary mining plan and metallurgical plant design were completed for the Sanchez deposit near Safford. No decision has been announced concerning future development of this property.

The smelter treated 355,814 tons of copper-containing material, which was 32% more than in 1971. Toll and custom material provided 59% of the tonnage smelted. Construction of the new $50 million electric smelter was on schedule; completion was expected late in 1973. Capacity will be a nominal 1,500 tons of concentrate per day, adequate to smelt the output of Inspiration mines and those of custom shippers. New equipment includes an electric smelting furnace, five siphon-type converters, a gas cleaning system, and a double adsorption acid plant of 1,330-ton-per-day capacity.[10]

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[9] Work cited in footnote 8.

The Twin Buttes mine produced 18,661,000 tons of ore and 79,122 tons of recoverable copper in concentrate, compared with 7,666,000 tons of ore and 53,331 tons of copper in 1971. Some of the concentrates produced during 1972 were not smelted because of curtailed operations at the custom smelter due to equipment failure and air quality regulations. Waste stripped was 98,763,000 tons, a 26% increase from 1971 production.

In July agreements in principle were announced between Banner Mining Co., American Metal Climax Inc. (AMAX), and The Anaconda Company, conditioned on approval by Banner shareholders and on reaching an operating agreement between The Anaconda Company and AMAX. The proposed agreements provided that Banner shareholders would exchange their equity for convertible preferred AMAX stock. Following this transaction, Anaconda and AMAX would agree to operate the Twin Buttes mine and other former Banner properties as partners, with AMAX contributing $93 million to the partnership for expansion of production facilities at Twin Buttes. Further planned expansion cost would be shared equally by the two companies as would other future capital costs, operating responsibility, and metal produced.

Planned expansions will increase annual copper production capacity to 120,000 tons during the next 3 years and will cost about $200 million. Concentrating capacity for sulfide ore will be gradually increased from the present 30,000 tons per day to 40,000 tons by additions of new equipment to present mill circuits. A plant to extract 30,000 tons of cathode copper per year from oxide ores will be constructed at an estimated cost of $59 million; completion is expected in 1975. The plant will vat leach 10,000 tons of ore per day and recover the dissolved copper by liquid ion exchange and electrolytic precipitation. Over 20,000,000 tons of oxide ore has been stockpiled from material stripped from the sulfide ore body.

The Twin Buttes deposit is large enough to support additional expansion. Reported proven reserves are 447 million tons of sulfide ore grading 0.67% copper and 55 million tons of oxide ore grading 0.91% copper. A large quantity of ore is also indicated in partially explored portions of the deposit. Several other copper deposits were included in the Banner-AMAX-Anaconda transaction, and they are available for future development by the Anaconda-AMAX partnership. These include the Helvetia deposit containing a reported reserve of 320 million tons of sulfide ore grading 0.64% copper and 43 million tons of oxide ore grading about 0.65% copper, and the Palo Verde deposit containing a reported 95 million tons grading 0.74% copper.

Miami Copper operations of Cities Service Co. produced 5,962 tons of copper from precipitates, a 7% decrease from the 1971 level. The Copper Cities open pit mine produced 5,052,617 tons of concentrating ore and 23,653 tons of recoverable copper, including 2,225 tons from dump leaching, increases of 9% and 4%, respectively, from 1971 levels. A total of 5,461,000 tons of material was placed in leach dumps and 5,584,000 tons was placed in waste dumps. The Copper Cities ore body is expected to be depleted by 1975, about the time the Pinto Valley mine is brought into production.

Initial preparation for the Pinto Valley mine was begun in May; by the end of 1972, waste stripping had reached a depth of 200 feet. The top of the ore body lies 500 feet below the original ground surface and 56 million tons of material will be moved before full-scale ore production begins. Mine operations will be at a daily rate of 40,000 tons of concentrating ore and 60,000 tons of combined leach material and waste. Present plans are to continue mining to 1,200 feet below the top of the ore; ore reserves of 350 million tons grading 0.44% recoverable copper have been developed above this level. Plant construction was 15% complete at the end of 1972, and mine and concentrator output is expected to reach the 40,000-ton-per-day capacity early in 1975. Provisions have been incorporated in the plant design to allow for future expansion if economic conditions and mineral resources warrant. Cost of the new mine and concentrator are estimated at over $100 million.

Development continued at the Miami East ore body, a down-faulted segment of

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[10] Inspiration Consolidated Copper Co. 1972 Annual Report. 21 pp.

the original Miami-Inspiration deposit. This segment contains 50 million tons grading 1.95% copper and lies at a depth of 2,500 to 3,700 feet. An existing shaft is being deepened to 3,250 feet. When this is completed in 1973, preproduction development will be started. Ore production was expected to begin in late 1974 and to reach a rate of 2,000 tons per day by 1978.

Hecla Mining Co. and El Paso Natural Gas Co. continued exploration, mine development, metallurgical testing, and plant engineering, and began plant construction at the Lakeshore deposit near Casa Grande. About 36,000 feet of drilling was done from the surface to delineate the north portion of the deposit and explore surrounding ground. About 8,000 feet of drilling was done underground to provide detailed information on the sulfide ore body for mine planning.

Two parallel declines for conveyor belt haulage and a skipway were continued on a —15° slope from the collar elevation of 1,915 feet to a vertical depth of 1,750 feet. Planned initial depth of the inclines is 1,915 feet where an underground crusher will be installed. The sulfide ore body was developed by numerous crosscuts at the 500-foot elevation and test stoping was begun. The oxide ore body is being opened by a crosscut at the 1,100-foot elevation that was advanced nearly to the ore zone. Two ventilation shafts and a small service shaft were also completd.

Pilot concentration, roast-leach-electrowinning, and vat leach-cementation plants were operated and provided data for plant design. Metallurgical testing is continuing on vat leaching-cementation and sponge iron manufacturing processes. Design of the concentrator was completed and construction was begun. Design of the other metallurgical plants is in progress. Production is expected to start in early 1975 at an initial rate of 9,000 tons per day of sulfide ore and 6,500 tons per day of oxide ore. Total cost is estimated at $140 million.

Financial arrangements of the El Paso Natural Gas Co.—Hecla Mining Co. partnership were modified, effective in 1973. Under the former agreement, Hecla had purchased a 50% interest in the deposit from El Paso and had assumed responsibility for placing the deposit in production. Repayment of preproduction costs, which had been assumed by Hecla, were to have first claim on earnings, with subsequent earnings shared equally. The new agreement provides that El Paso and Hecla will operate the project jointly and share equally in preproduction costs and earnings.

El Paso Natural Gas Co. produced 257,287 tons of ore and 1,773 tons of copper from the Emerald Isle open pit mine and leach-precipitation float plant in Mohave County.

The Bagdad Copper Corp. produced 12,279 tons of copper in concentrates from 1,982,318 tons of sulfide ore, and 6,695 tons of cathode copper from leaching of oxidized copper containing material. Purchased copper precipitates were used in the copper powder refinery, which produced 2,169 tons of copper powder.[11] The stockpile of copper concentrates resulting from the 1971 strike at custom smelters, was reduced from 2,150 tons of contained copper at the start of 1972 to about one-third that quantity at yearend by shipments to the White Pine, Mich., smelter.

The feasibility of expanding mine and mill production and installing a concentrate processing plant were studied during the year. Present Bagdad production comes from an ore body containing 38 million tons of sulfide ore grading 0.66% copper that is overlain with 12.5 million tons of oxidized copper containing material. Exploration has established the presence of an additional 250 million tons of sulfide ore grading 0.47% copper that is overlain by 313.3 million tons of oxidized copper containing material and waste. Cost estimates were made for enlarging mine and concentrator capacity and for constructing a concentrate processing plant since regional custom smelters are usable to treat additional concentrates. Processing methods evaluated included a small smelter at Bagdad, a larger smelter at a central location and operated jointly with other concentrate shippers, and a roast-leach-electrowinning plant. Estimated cost of the expansion was $60 million for enlarging mine and concentrator capacity to 30,000 tons per day and in the order of $25 million for smelting or other concentrate treatment facilities.

The Bluebird mine of Ranchers Exploration and Development Corp. produced 7,346 tons of cathode copper, about 18% more than in 1971. Production of nearly 2,000 tons was made in the fourth quarter. About 15% more ore was placed on leach dumps than during the previous year; however, the average grade of ore mined decreased 5% to about 0.43% copper. Waste stripping increased about 30%.[12] Improvements were made during the summer in the tankhouse to increase cathode density and purity.

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[11] Bagdad Copper Corp. Joint Proxy Statement and Prospectus. Mar. 26, 1973, pp. 31–35.

An oxidized ore body at the Old Reliable property was prepared for in place leaching by Ranchers and E. I. du Pont de Nemours & Co., Inc. Ranchers has a 60% interest in the project, Du Pont 20%, and Occidental Minerals Corp. 20%. The first cement copper was precipitated in September, and the full production rate of 10 tons of copper per day was expected to be attained by the spring of 1973. The ore body contains about 4 million tons of ore grading 0.8% copper. Tests indicate that about one-half of the copper can be recovered within a 5-year period.

On March 9, a single blast broke the ore body into pieces averaging less than 9 inches in diameter for percolation leaching. This was the largest nonnuclear explosion ever detonated and consumed 3,994,000 pounds of ammonium nitrate and fuel oil, which was placed in 6,000 feet of 6- by 6-foot powder drifts. Total breaking cost was $753,000. Following the blast, the ground surface above the ore body was graded into terraces for the distribution of sulfuric acid solution and a sprinkling system installed. Enriched solution was collected in underground workings below the ore body. A copper recovery plant was constructed that included six precipitation cells, precipitate drying and storage areas, acid storage tanks, and iron storage pads. At full capacity, 1,000 gallons per minute of acid solution is sprayed on the leach dump to provide 800 gallons per minute of pregnant liquor for the precipitating plant. Makeup water is pumped from a well 2,000 feet deep located 6 miles distant and 2,000 feet below the leach dump.

McAlister Fuel Co. produced 2,389 tons of copper from the Zonia open pit mine and heap leaching plant near Kirkland.[13] The mine is being prepared for "in place" leaching. A single extremely large blast will be used to shatter the ore body, following which a copper leaching system will be installed. Sulfuric acid will be distributed on the surface of the broken ore, allowed to percolate to the bottom of the broken ore, and regathered in drill holes for pumping to the precipitation plant.

Little Hill Mines, Inc. shipped fluxing ore from the Gold Hill mine near Oracle. Big Hole Mining Co. shipped 6,214 tons of ore containing 289 tons of copper, and 104 tons of precipitates containing 66 tons of copper from workings in the United Verde open pit near Jerome. E. M. Moores, Jr., shipped 42,375 tons of fluxing ore containing 103 tons of copper from the Copper Hill Mine near Globe. McFarland and Hullinger shipped 83,493 tons of tailings containing 139 tons of copper for use as flux from the Tiger dump near Mammoth. Shipments of copper ore, fluxing ore, precipitate, or cleanup ore were made from eight other properties.

Gold.—Gold production was 102,990 troy ounces, an increase of 10% from the strike-reduced production of 1971 but was 6% below the 1970 output. Nearly all the output was recovered from copper concentrates and direct smelting ore. Several hundred ounces was recovered from copper fluxing material and a small quantity from zinc concentrates.

Iron Ore.—CF&I Steel Corp. mined and shipped development ore from the Apache pit in Navajo County to its steel plant in Pueblo, Colo. Chas. Pfizer and Co. shipped a small quantity of stockpiled ore from the Cowden mine in Yavapai County.

Lead.—Lead production increased to 1,763 tons from 859 tons the previous year. The increase resulted from greater byproduct recovery from copper and copper-zinc ores and from renewed production of lead-zinc ore at the Sunrise (formerly Glove) mine in northeastern Santa Cruz County by the CF&I Steel Corp. About 62% of the State output was byproduct lead from large porphyry copper mines.

Molybdenum.—Molybdenum shipments were 27.2 million pounds, an increase of 20% from 1971 when strikes reduced mine production. Production of recoverable molybdenum, as reported by the Arizona Department of Mineral Resources[14] was 26.2 million pounds about 11% more than in 1971. All production was recovered as a byproduct of copper mining at 12 concentrators having molybdenum circuits. Production changes between the 2 years varied greatly at individual plants because of lower molybdenum demand and prices in 1972. Plants treating ore containing considerable byproduct molybdenum continued their usual recovery process; output reflected changes in plant size and operating rates. Plants treating ores having relatively low molybdenum content could not economically recover molybdenum during the entire year. Large increases were made at Sierrita, San Manuel, and Twin Buttes. Decreases occurred at Esperanza, which was closed all year, and at Inspiration and Ray. At Ray, the molybdenum plant was closed in January 1972 but was reopened in January 1973 after prices had increased and molybdenum inventories had been reduced to a working level.

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[12] Ranchers Exploration and Development Corp. 1972 Annual Report. 29 pp.

[13] Work cited in footnote 3.

[14] Work cited in footnote 3.

Silver.—Silver production was 6.7 million ounces, an increase of 8% from that of the previous year. About 98.5% of the silver production came from copper concentrating and direct smelting ores, about 0.6% from fluxing material used in copper smelting, and the remainder from copper-zinc and lead-zinc ores.

Tungsten.—A small output was reported from the Carboloy mine in Pima County, and a few tons of development ore were produced from the Big Banana property in the same county.

Zinc.—Zinc production was 10,111 tons of recoverable zinc compared with 7,761 tons produced in 1971. About 90% of the State total was produced at the Bruce copper-zinc mine, which is described under copper. Most of the remaining output came from the Sunrise lead-zinc mine. A small tonnage was recovered at the Sierrita copper-molybdenum mine from porphyry ore.

NONMETALS

Asbestos.—Chrysotile asbestos was produced by Jaquays Mining Corp. from underground operations 33 miles north of Globe and processed in a mill on the east side of Globe. Shipments of fiber increased about 2% in quantity but decreased 14% in value.

Cement.—Shipments of portland cement increased 13% from 1971 and shipments of masonry cement increased 26%. Types of portland cement shipped were general use, moderate heat, high-early-strength, and high-sulfate-resistant. Portland cement consumption was 1,544,293 tons. Sixty-two percent of the cement was used in ready-mix concrete plants. Eighteen percent was consumed in concrete product manufacturing, and the remainder was used in concrete mixed on the construction site.

Arizona Portland Cement Co. completed an enlargement of its Rillito plant from 500,000 to about 800,000 tons, late in the year. The cost was about $20 million, of which over $3 million was spent directly on pollution control. Principal new items installed included limestone mining and crushing facilities; an 18,500-foot enclosed single-flight conveyor, the longest in the United States, extending from the limestone quarry to the plant; a stacking and reclaiming system enclosed in a 760- by 140- by 53-foot-high building; a 15.5- by 21-foot raw grinding mill; a 215-foot-high preheating tower; and a 1,880-ton-per-day kiln. Further enlargement is planned to increase capacity to 1,000,000 tons per year. Phoenix division of the American Cement Corp., completed a $2.7 million expansion and pollution control program at its Clarkdale plant. Production capacity was increased 21% to 660,000 tons per year by improvements to the kilns and the installation of another finishing grinding mill. Air pollution was greatly reduced by enlargements of the bag-house-type dust collectors on the kilns and installation of new dust collectors on clinker cooling units.

Clay.—Production of common clay, shale, and bentonite was 134,372 tons valued at $355,251. Producers of clay for brickmaking were Phoenix Brick Yard and Wallapai Brick & Clay, Maricopa County; and Phoenix Brick Yard and Tucson Pressed Brick Corp., Pima County. Clay for cement manufacture was mined by American Cement Corp. in Yavapai County. Bentonite was mined by the Filtrol Corp. and McCarrell & Gurley, Apache County; and by Arizona Gypsum Corp., Yavapai County. Kaolin was mined by McKusick Mosaic Co., Gila County. Fire clay was mined by Magma Copper Co., Pinal County.

Diatomite.—Superior Companies mined and processed diatomite at the White Cliff property near Mammoth, Pinal County. Production decreased 61%. The unit value of the product, which was used for filler, decreased 15%.

Feldspar.—Hand-cobbed feldspar was produced at the Taylor mine near Kingman, Mohave County. The feldspar was ground in the Arizona Feldspar Corp. plant at Kingman and shipped to California and other States for use in glass and pottery manufacturing. Production of cobbed ore increased 4%, and the unit price as received increased 25%.

Fluorspar.—Fluorspar production increased several fold following the opening of a flotation mill near Punkin Center, Gila County, by the Tonto Basin Mining and Milling Co. in late 1971. A second ball mill was added in June that increased capacity to 125 tons per day. Crude ore is mined at three nearby vein mines. The fluoride concentrate is of acid grade and is used in California.

Gem Stones.—The estimated value of collected gem stones was $168,000 compared with $160,000 in 1971. Gem stones collected include agate, petrified wood, turquoise, chrysocolla, and obsidian.

Gypsum.—National Gypsum Co. mined crude gypsum near Winkelman and produced calcine at its Phoenix plant. Superior Companies mined gypsum near Camp Verde and near Winkelman for use as a cement retarder and agricultural soil conditioner. Pinal Mammoth Gypsum Co. mined gypsum near Coolidge for agricultural use. State output increased 12% from the 1971 level. About 49% of the production was calcined, about 48% used for cement additive, and 3% for soil conditioning. A thickness of 6,000 feet of anhydrite was encountered in an oil well drilled near Picacho, indicating possible gypsum deposits in this area.

Lime.—Lime production increased 20% from the 1971 output to a record 355,510 tons, which was 15% above the previous high established in 1970. Eight companies produced lime at eight plants in seven counties. Leading counties were Cochise, Greenlee, and Gila. Leading producers were Paul Lime Plant Inc., Phelps Dodge Corp., and Santa Rita Mining Co. Nearly 92% of the lime was used in copper ore concentration; the remainder for sugar refining, mason's lime, and other uses. Total lime consumption in Arizona was 344,100 tons.

Mica.—Ground mica was produced from the Buckeye mine near Buckeye for use in well drilling fluid, roofing, paints, and rubber. Scrap mica was produced from the San Antonio mine near Ajo.

Perlite.—Perlite was produced from three open pits near Superior. Harborlite Corp. mined perlite from the Mary Ann claims for shipment to customers in Texas, California, and Michigan. Filters International Inc. mined and processed ore from the Chicago pit. Mike Guzman produced perlite for shipment to California. Output was considerably larger than in 1971, when operations were suspended while dust control equipment was being installed. Output was about 2% higher than in 1970. Perlite expanding plants were idle.

Pumice and Pumicite.—A total of 915,000 tons of volcanic cinders valued at $722,000 and 530 tons of pumice valued at $900 were produced by 10 companies, the State Highway Department, and the Apache and Coconino County Highway Departments. Output decreased 4% in quantity but increased 16% in value from those of 1971. Twenty-four percent of the cinders were crushed and screened, and the remainder was used without preparation. Unprepared cinders had an average value of 69 cents per ton and crushed cinders, $1.09 per ton. The cinders were used as follows: for road construction (37%), for railroad ballast (28%), and for concrete aggregate and other uses (35%).

Pyrite.—A small quantity of pyrite produced as a byproduct at the Magma Copper Co. concentrator at Superior was sold to the Ray Mines Division as a supplemental feed for sulfuric acid manufacture.

Sand and Gravel.—Sales of sand and gravel increased 26% in quantity and 33% in value from those of 1971 to 24.8 million tons valued at $32.4 million. Output was reported from 142 operations, 33 more than in 1971. Of the total output, 7.4 million tons was classified as sand valued at $11.6 million and 17.5 million tons as gravel valued at $20.8 million.

Sales from commercial pits were 6.7 million tons of sand valued at $10.8 million and 15.9 million tons of gravel valued at $18.3 million. Government-and-contractor output consisted of 0.6 million tons of sand valued at $0.8 million and 1.6 million tons of gravel valued at $2.5 million.

Overall consumption by quantity was building 47%, paving 43%, fill 7%, and all other 3%. Other includes railroad ballast gravel, furnace, blast, and hydrofracture sand, and other sand and gravel uses. Consumption by value was building 48%, paving 41%, fill 5%, and all other 6%. Sand and gravel was produced and used in all 14 counties. Maricopa County produced 63% of the State output and Pima County 11%.

Stone.—In 1972 stone production increased 61% in quantity to 4.6 million tons and 37% in value to $8.0 million. Limestone, quartz, quartzite, traprock, marble, sandstone, and other rock were mined and marketed as crushed and broken stone. Sandstone, marble, quartzite and other stone were sold as dimension stone. Uses of crushed and broken stone included roadbase, concrete aggregate, bituminous roadmix aggregate, cement, lime, smelter flux, terrazzo, acid neutralizer, whiting, and roof granules. Dimension stone was principally used for rough blocks and stone, dressed architectural stone, and flagging.

Table 13.—Arizona: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Apache	2	10	102	3	53	138
Cochise	5	W	W	12	806	1,489
Coconino	3	W	W	1	76	202
Gila	4	96	283	6	160	553
Graham	4	120	176	5	116	283
Maricopa	22	12,912	14,022	32	15,675	18,198
Mohave	6	373	697	8	764	1,774
Navajo	8	295	340	9	787	933
Pima	22	3,749	4,951	26	2,704	4,773
Pinal	8	364	941	8	875	1,408
Santa Cruz	5	117	228	3	W	W
Yavapai	8	676	1,262	14	644	970
Yuma	6	633	813	9	W	1,194
Undistributed [1]	6	444	575	6	2,182	505
Total [2]	109	19,791	24,391	142	24,842	32,420

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Greenlee and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 14.—Arizona: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	6,769	8,438	4,159	6,880
Fill	766	434	579	655
Fire and furnace	--	--	191	696
Paving	1,512	1,281	1,632	2,100
Other uses [1]	201	466	178	509
Total [2]	9,248	10,619	6,738	10,839
Gravel:				
Building	4,319	6,450	7,325	8,610
Fill	729	610	956	780
Paving	2,770	3,737	7,269	8,050
Miscellaneous	W	W	119	313
Other uses [3]	145	352	211	538
Total [2]	7,963	11,147	15,881	18,292
Government-and-contractor operations:				
Sand:				
Building	--	--	19	26
Fill	16	9	57	13
Paving	527	737	564	752
Total [2]	543	746	641	791
Gravel:				
Building	37	36	35	48
Fill	791	278	231	66
Paving	1,102	1,441	1,316	2,385
Other uses	108	124	--	--
Total [2]	2,038	1,879	1,583	2,499
Total sand and gravel [2]	19,791	24,391	24,842	32,420

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes railroad ballast, blast, oil (hydrofrac), and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes miscellaneous, railroad ballast, and other gravel.

Table 15.—Arizona: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Apache	1	W	W	1	10	39
Cochise	16	828	2,151	11	1,509	2,397
Graham	3	W	39	3	44	95
Maricopa	6	W	W	7	W	142
Navajo	1	W	10	1	W	10
Pima	10	554	884	9	W	2,472
Santa Cruz	1	31	W	1	55	W
Yuma	2	W	W	1	6	W
Undistributed [1]	52	1,460	2,764	31	3,012	2,862
Total [2]	92	2,873	5,848	65	4,638	8,018

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Coconino, Gila, Greenlee, Mohave, Pinal, and Yavapai Counties.

[2] Data may not add to totals shown because of independent rounding.

Table 16.—Arizona: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension [1]	14	292	7	167
Crushed and broken:				
Limestone	1,548	2,884	2,397	3,594
Sandstone, quartz, quartzite	447	1,077	556	1,440
Traprock	435	W	613	W
Other stone [2]	428	1,595	1,064	2,816
Total [3]	2,859	5,556	4,630	7,850
Grand total [3]	2,873	5,848	4,638	8,018

W Withheld to avoid disclosing individual company confidential data; included with "Other stone."

[1] Includes marble, sandstone, quartz, and other stone.

[2] Includes data for marble and granite.

[3] Data may not add to totals shown because of independent rounding.

Table 17.—Arizona: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension:				
Rough blocks	6	148	4	83
Irregular-shaped stone	W	W	([1])	3
Dressed architectural ...thousand cubic feet	63	65	12	23
Other uses [2]	4	79	3	57
Total ...thousand short tons	14	292	7	167
Crushed and broken:				
Bituminous aggregate [3]	240	370	398	597
Concrete aggregate	163	307	135	348
Dense graded roadbase stone	468	875	958	1,115
Surface treatment aggregates	17	35	52	107
Lime manufacture	553	1,233	677	1,459
Fluxstone	613	1,416	685	1,781
Riprap and jetty stone	2	3	4	W
Stone sand	108	W	89	W
Refractory stone	W	W	10	W
Other uses [4]	700	1,318	1,624	2,443
Total [5]	2,859	5,556	4,630	7,850
Grand total [5]	2,873	5,848	4,638	8,018

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."

[1] Less than ½ unit.

[2] Includes data for flagging, rubble and uses not specified.

[3] Data includes macadam and unspecified aggregates.

[4] Includes agricultural purposes, filter stone (1972), terrazzo, cement manufacture, acid neutralization, and other uses not specified.

[5] Data may not add to totals shown because of independent rounding.

Vermiculite.—Ari-Zonolite Co. exfoliated vermiculite concentrate shipped from out of State, at its mill in Phoenix. The product was mainly used for block insulation, concrete aggregate, and fireproofing.

MINERAL FUELS

Coal (Bituminous.)—The Peabody Coal Co., Division of Kennecott Copper Corp., produced 2,953,654 tons of coal, as reported in the Keystone Coal Industry Manual[15] from the Black Mesa No. 1 mine on Navajo and Hopi Indian lands near Kayanta. At the end of the year, production had reached a rate of about 350,000 tons per month. All coal produced was delivered through a 275-mile slurry pipeline to the Mohave powerplant near Davis Dam, Nev. Coal deliveries from the No. 1 mine are scheduled to reach 5 million tons per year when the generating capacity of the Mohave plant reaches its design capacity of 1,500 megawatts.

Construction continued on the Navajo powerplant near Page, and on the Black Mesa No. 2 mine, which will supply coal to the plant. The powerplant will contain three units of 770 megawatts each that are scheduled for completion in 1974, 1975, and 1976. Coal consumption will be 8 million tons per year at full generating capacity. An electric railroad system to haul coal from the mine to the powerplant was nearly completed.

Helium.—Helium production was about one-fourth more than in 1971. The Kerr-McGee Corp. plant near Navajo, Apache County, recovered helium throughout the year from the Pinta Dome field. Western Helium Corp. purchased an idle plant, also near Navajo, and commenced recovery of helium from the Navajo Springs and East Navajo Springs fields.

Natural Gas.—Marketed natural gas decreased 49% in quantity and 48% in value from those in 1971. All production was from wells in Apache County. Two successful gas wells were completed by Cities Service Oil Co. in northeastern Apache County. A hole drilled 4 miles southeast of the Dry Mesa field in late 1971 tested at a 7.4 million-cubic-feet-per-day rate on open flow. A second hole, 1 mile north, tested 2.87 million cubic feet per day on open flow.

Petroleum.—Petroleum production was 993,000 barrels valued at $3,226,000, a decline of 20% in quantity and 18% in value from those of 1971. Exxon Corp. explored 1.6 million acres of leased ground in the southern part of the State. Work completed included geological and geophysical studies and three drill tests, none of which encountered oil or gas. One hole was drilled east of Elk Wash in Yuma County to a depth of 2,628 feet, another hole north of Picacho was drilled to a depth of 10,179 feet, and a third, south of Tucson, to a depth of 12,556 feet.[16]

Table 18.—Arizona: Oil and gas well drilling, by county

County	Oil	Gas	Dry	Total	Footage
1971:					
Exploratory completions:					
Apache	--	1	2	3	16,283
Graham	--	--	1	1	3,500
Navajo	--	--	1	1	1,006
Total	--	1	4	5	20,789
Development completions:[1]					
Apache	--	1	2	3	3,760
Total all drilling	--	2	6	8	24,549
1972:					
Exploratory completions:					
Apache	--	1	5	6	19,882
Cochise	--	--	1	1	5,679
Navajo	--	--	2	2	2,528
Yavapai	--	--	2	2	5,057
Yuma	--	--	1	1	3,986
Total	--	1	11	12	37,132
Development completions:[1]					
Apache	5	--	5	10	22,394
Total all drilling	5	1	16	22	59,526

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

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[15] Keystone Coal Industry Manual. McGraw-Hill Book Co., Inc., New York, 1972, p. 605.

[16] Petroleum Information Corp. Resume Oil and Gas Operations in the Mid-Continent, Rocky Mountain and Northeast Regions. Annual Publication, Denver, Colo., 1972, pp. RM21–22, 1–A.

Table 19.—Principal producers

Commodity and company	Address	Type of activity	County
Asbestos: Jaquays Mining Corp.	1219 South 19th Ave. Phoenix, Ariz. 85009	Underground mine and crushing, screening, and air-separation plant.	Gila.
Cement:			
American Cement Corp., Phoenix Div.	2404 Wilshire Blvd. Los Angeles, Calif. 90057	Dry process, 3-rotary-kiln plant.	Yavapai.
Arizona Portland Cement Co., a division of California Portland Cement Co.	800 Wilshire Blvd. Los Angeles, Calif. 90017	----do----------	Pima.
Clays:			
American Cement Corp., Phoenix Div.	2404 Wilshire Blvd. Los Angeles, Calif. 90057	Open pit mine	Yavapai.
Filtrol Corp	3250 East Washington Blvd. Los Angeles, Calif. 90023	----do----------	Apache.
McCarrell & Gurley	Box 1377 Gallup, N. Mex. 87301	----do----------	Do.
Phoenix Brick Yard	1814 South 7th Ave. Phoenix, Ariz. 85007	----do---------- ----do----------	Maricopa. Pima.
Tucson Pressed Brick Corp	Box 2592 Tucson, Ariz. 85702	----do----------	Do.
Wallapai Brick & Clay	Box 1528 Phoenix, Ariz. 85001	----do----------	Maricopa.
Coal: Peabody Coal Co	3800 North Central Ave. Phoenix, Ariz. 85012	----do----------	Navajo.
Copper:			
American Smelting and Refining Co.:			
Mission Unit	Box 111 Sahuarita, Ariz. 85629	Open pit mine and mill.	Pima.
San Xavier Unit	----do----------	Open pit mine	Do.
Silver Bell Unit	Silver Bell, Ariz. 85270	Open pit mine, mill, leach dumps, and precipitation plant.	Do.
Hayden Unit	Hayden, Ariz. 85235	Custom smelter	Gila.
The Anaconda Company	Box 127 Sahuarita, Ariz. 85629	Open pit mine and mill.	Maricopa.
Bagdad Copper Corp	Box 245 Bagdad, Ariz. 86321	Open pit mine, mill, leach dumps, electrowinning plant, and copper powder refinery.	Yavapai.
Cities Service Co., Miami Copper Co. Div.	Box 100 Miami, Ariz. 85539	Open pit mine, mill, leach dumps and in place leaching, and precipitation plants.	Gila.
Cyprus Mines Corp., Bruce Mine Div.	Box 457 Bagdad, Ariz. 86321	Underground mine and mill.	Yavapai.
Duval Corp.:			
Esperanza Property	Box 125 Sahuarita, Ariz. 85629	Open pit mine, leach dumps, and precipitation plant.	Pima.
Mineral Park Property	Box 1271 Kingman, Ariz. 86401	----do----------	Mohave.
Duval Sierrita Corp	Box 125 Sahuarita, Ariz. 85629	Open pit mine and mill.	Pima.

Table 19.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Copper—Continued			
Inspiration Consolidated Copper Co.	Inspiration, Ariz. 85537	Open pit mine, mill, vat leaching plant, electrowinning plant, in place leaching, heap leaching, precipitation plant, rod plant rolling mill, custom smelter, electrolytic refinery.	Gila.
Kennecott Copper Corp., Ray Mines Div.	Hayden, Ariz. 85235	Open pit mine, leach dumps and in place leaching, and precipitation plant.	Pinal.
		Mill, vat leaching plant, electrowinning plant, and smelter.	Gila.
Magma Copper Co.:			
San Manuel Div	Box M San Manuel, Ariz. 85631	Underground mine, mill, smelter, and refinery.	Pinal.
Superior Div	Box 37 Superior, Ariz. 85273	Underground mine, and mill.	Do.
Phelps Dodge Corp.:			
Copper Queen Branch	Drawer K Bisbee, Ariz. 85603	Open pit mine, underground mine, mill, leach dumps and in place leaching, and precipitation plant.	Cochise.
Douglas Reduction Works.	Drawer E Douglas, Ariz. 85607	Custom smelter	Do.
Morenci Branch	Morenci, Ariz. 85540	Open pit mine, mill, leach dumps, precipitation plant, and smelter.	Greenlee.
New Cornelia Branch	Drawer 9 Ajo, Ariz. 85321	Open pit mine, mill, and smelter.	Pima.
Pima Mining Co	Box 7187 Tucson, Ariz. 85713	Open pit mine and mill.	Do.
Ranchers Exploration and Development Corp.	Box 6217 Albuquerque, N. Mex. 87107	Open pit mine, heap leaching, and electrowinning plant.	Gila.
Diatomite: Superior Companies	Box 6497 Phoenix, Ariz. 85005	Open pit mine and plant.	Pinal.
Feldspar: International Minerals & Chemical Corp., Industrial Minerals Division.	Box 229 Kingman, Ariz. 86401	do	Mohave.
Gold:			
Magma Copper Co.:			
San Manuel Div	Box M San Manuel, Ariz. 85631	*See* Copper	Pinal.
Superior Div	Box 37 Superior, Ariz. 85273	do	Do.

Table 19.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Gold—Continued			
Phelps Dodge Corp.:			
Copper Queen Branch	Drawer K Bisbee, Ariz. 85603	*See* Copper	Cochise.
Morenci Branch	Morenci, Ariz. 85540	do	Greenlee.
New Cornelia Branch	Drawer 9 Ajo, Ariz. 85321	do	Pima.
Gypsum:			
Superior Companies:			
Verde Division	Box 6497 Phoenix, Ariz. 85005	Open pit mine and plant.	Yavapai.
Winkelman Division	do	do	Pinal.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Do.
Helium: Kerr-McGee Corp., Gas Processing Department.	Kerr-McGee Bldg. Oklahoma City, Okla. 73102	6 wells and plant; Pinta Dome field.	Apache.
Iron ore: CF&I Steel Corp	Box 316 Pueblo, Colo. 81002	Open pit mine	Navajo.
Lime:			
Paul Lime Plant, Inc	Drawer T Douglas, Ariz. 85607	5-rotary-kiln plant.	Cochise.
Phelps Dodge Corp., Morenci Branch.	Morenci, Ariz. 85540	1-rotary-kiln, 1 fluidized-bed-kiln plant.	Greenlee.
Mica: San Antonio Mica Co	Box 397 Ajo, Ariz. 85321	Open pit mine	Pima.
Molybdenum:			
American Smelting and Refining Co.:			
Mission Unit	Box 111 Sahuarita, Ariz. 85629	*See* Copper	Do.
Silver Bell Unit	Silver Bell, Ariz. 85270	do	Do.
The Anaconda Company	Box 127 Sahuarita, Ariz. 85629	do	Do.
Bagdad Copper Corp	Box 245 Bagdad, Ariz. 86321	do	Yavapai.
Cities Service Co., Miami Copper Co. Div.	Box 100 Miami, Ariz. 85539	do	Gila.
Duval Corp.:			
Esperanza Property	Box 125 Sahuarita, Ariz. 85629	do	Pima.
Mineral Park Property	Box 1271 Kingman, Ariz. 86401	do	Mohave.
Duval Sierrita Corp	Box 125 Sahuarita, Ariz. 85629	Open pit mine, mill, and roaster.	Pima.
Inspiration Consolidated Copper Co.	Inspiration, Ariz. 85537	*See* Copper	Gila.
Kennecott Copper Corp., Ray Mines Div.	Hayden, Ariz. 85235	do	Pinal.
Magma Copper Co., San Manuel Div.	Box M San Manuel, Ariz. 85631	do	Do.
Pima Mining Co	Box 7187 Tucson, Ariz. 85718	do	Pima.
Perlite:			
Filters International Inc	Route 1, Box 720 Miami, Ariz. 85539	Open pit mine and plant.	Gila.
Harborlite Corp	Superior, Ariz. 85273	do	Pinal.
Petroleum:			
Exxon Corp	2000 Classen Center-North Oklahoma City, Okla. 73106	Crude oil; East Boundary Butte field.	Apache.
Kerr-McGee Corp	Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Crude oil; Dineh bi Keyah field.	Do.
Pumice:			
Apache County Highway Department.	Box 428 St. Johns, Ariz. 85936	Open pit mine	Apache.
Atchison Topeka & Santa Fe Railway.	Winslow, Ariz. 86047	Open pit mine and plant.	Coconino.
Superlite Builders Supply, Inc.	5201 North 7th St. Phoenix, Ariz. 85014	Open pit mine	Do.
Pyrites: Magma Copper Co., Superior Div.	Box 37 Superior, Ariz. 85273	*See* Copper	Pinal.

Table 19.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel (commercial):			
Arizona Sand & Rock Co	Box 20067 Phoenix, Ariz. 85036	Pits and plants	Maricopa, Pima, Pinal.
Tanner Brothers Contracting Co.	Box 20128 Phoenix, Ariz. 85034	do	Apache, Maricopa, Navajo, Pinal, Yavapai, Yuma.
Tempe Equipment & Contracting Co.	8200 East Pima St. Tempe, Ariz. 85281	do	Maricopa.
Union Rock & Materials Corp., Bentson Contracting Co.	2800 South Central Ave. Phoenix, Ariz. 85040	do	Maricopa and Pima.
United Metro Materials & Concrete Co., Inc.	Box 13309 Phoenix, Ariz. 85002	do	Maricopa, Pima, Pinal, Yuma.
Silver:			
American Smelting and Refining Co.:			
Mission Unit	Box 111 Sahuarita, Ariz. 85629	*See* Copper	Pima.
San Xavier Unit	do	do	Do.
Silver Bell Unit	Silver Bell, Ariz. 85270	Open pit mine and mill.	Do.
The Anaconda Company	Box 127 Sahuarita, Ariz. 85629	*See* Copper	Do.
Bagdad Copper Corp	Box 245 Bagdad, Ariz. 86321	do	Yavapai.
Cities Service Co., Miami Copper Co. Div.	Box 100 Miami, Ariz. 85539	do	Gila.
Cyprus Mines Corp., Bruce Mine Div.	Box 457 Bagdad, Ariz. 86321	do	Do.
Duval Corp.:			
Esperanza Property	Box 125 Sahuarita, Ariz. 85629	do	Pima.
Mineral Park Property	Box 1271 Kingman, Ariz. 86401	do	Mohave.
Duval Sierrita Corp	Box 125 Sahuarita, Ariz. 85629	do	Pima.
Inspiration Consolidated Copper Co.	Inspiration, Ariz. 85537	do	Gila.
Kennecott Copper Corp., Ray Mines Div.	Hayden, Ariz. 85235	do	Pinal.
Magma Copper Co.:			
San Manuel Div	Box M San Manuel, Ariz. 85631	do	Do.
Superior Div	Box 37 Superior, Ariz. 85273	do	Do.
Phelps Dodge Corp.:			
Copper Queen Branch	Drawer K Bisbee, Ariz. 85603	do	Cochise.
Morenci Branch	Morenci, Ariz. 85540	do	Greenlee.
New Cornelia Branch	Drawer 9 Ajo, Ariz. 85321	do	Pima.
Pima Mining Co	Box 7187 Tucson, Ariz. 85713	do	Do.
Stone:			
American Cement Corp., Phoenix Div.	2404 Wilshire Blvd. Los Angeles, Calif. 90057	Quarry and plant.	Yavapai.
Arizona Portland Cement Co	Rillito, Ariz. 85246	do	Pima.
New Pueblo Contractors	4115 East Illinois St. Tucson, Ariz. 85714	Quarry	Do.
Paul Lime Plant, Inc	Drawer T Douglas, Ariz. 85607	Quarry and plant.	Cochise.
Zinc: Cyprus Mines Corp., Bruce Mine Div.	Box 457 Bagdad, Ariz. 86321	*See* Copper	Yavapai.

The Mineral Industry of Arkansas

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Arkansas Geological Commission, under a memorandum of understanding for collecting information on all minerals except fuels.

By Grace N. Broderick [1]

Arkansas mineral production in 1972 was valued at $241.2 million, a decrease of 2.1% from the previous year's record high of $246.3 million. Nonmetallic minerals accounted for the major part of the total mineral value; mineral fuels comprised 39%; metals accounted for the remainder. Nationwide, Arkansas led in the production of bauxite, bromine, and vanadium; it continued to rank third in barite production. Petroleum remained the leading mineral commodity in value, accounting for $58.3 million. Output of coal increased to 427,873 short tons valued at $4.7 million.

Ninety percent of the first unit of Arkansas Power and Light Co.'s Arkansas Nuclear One Steam Electric Station was completed by the end of 1972. A construction permit for the second unit was issued in December by the U.S. Atomic Energy Commission. Personnel who will supervise and operate the nuclear station have been receiving specialized training both at the Russellville site and in actual operating nuclear powerplants outside Arkansas.

Liquid Carbonic Corp., a subsidiary of Houston Natural Gas Corp., reached an agreement with Arkla Chemical Corp., a subsidiary of Arkansas Louisiana Gas Co., under which Liquid Carbonic Corp. plans to build a new byproduct carbon dioxide recovery plant. The plant is to be built adjacent to Arkla Chemical Corp.'s Big River Fertilizer complex at Helena. The

Table 1.—Mineral production in Arkansas [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Bauxite .... thousand long tons, dried equivalent..	1,781	$24,979	1,634	$21,010
Clays [2] .... thousand short tons..	936	1,499	885	990
Coal (bituminous) .... do....	276	2,848	428	4,676
Gem stones	NA	30	NA	32
Lime .... thousand short tons..	157	2,313	150	2,456
Natural gas .... million cubic feet..	172,154	29,426	166,522	28,808
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels..	517	1,686	261	854
LP gases .... do....	1,035	2,650	546	1,420
Petroleum (crude) .... do....	18,263	56,805	18,519	58,335
Sand and gravel .... thousand short tons..	11,630	15,603	11,574	16,558
Stone .... do....	[r] 17,647	[r] 28,776	16,317	25,020
Value of items that cannot be disclosed: Abrasive stone, barite, bromine, cement, clays (kaolin), gypsum, mercury (1971), soapstone, tripoli, and vanadium	XX	79,703	XX	81,020
Total	XX	[r] 246,318	XX	241,179
Total 1967 constant dollars	XX	209,444	XX	[p] 200,637

[p] Preliminary. [r] Revised. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

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[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

plant will use gaseous carbon dioxide, a byproduct of Arkla's ammonia manufacturing operations, to produce liquid carbon dioxide. The new plant, which would produce 200 tons of liquid carbon dioxide per day, is expected to be completed before the summer of 1973.

Aggregate tonnage of shipments by barge on the Arkansas River Navigation System was comprised mainly of 5.2 million tons (about 93% of the total) of minerals and mineral products. Leading tonnages were ascribed to sand and gravel (2.3 million tons) and stone (1.3 million tons). Upstream shipments of bauxite to the Reynolds Metals facility near Bauxite, Ark., totaled 192,399 tons. More than 529,000 tons of coal was shipped by barge from coalfields in Oklahoma and Arkansas.

The first shipment of gasoline ever to travel the Arkansas River arrived in November at the new Murphy Oil Corp. storage facility located at the Little Rock Port Authority. Arrival of the 1.5 million gallons of gasoline marked the beginning of a new era of transportation for the petroleum industry of Arkansas.

Employment.—Preliminary data for 1972 and final data for 1971 compiled by the Federal Bureau of Mines for employment and injuries in the mineral industries, excluding the petroleum industry, are shown in table 4.

Table 2.—Value of mineral production in Arkansas, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Arkansas	--	$2	Sand and gravel, stone.
Ashley	W	188	Sand and gravel.
Baxter	W	581	Stone, sand and gravel.
Benton	W	W	Sand and gravel.
Boone	W	587	Stone, sand and gravel.
Bradley	W	W	Petroleum, sand and gravel.
Calhoun	$1,198	968	Sand and gravel, petroleum.
Carroll	W	W	Sand and gravel.
Clark	W	W	Sand and gravel, stone, clays.
Clay	170	224	Sand and gravel.
Cleburne	142	221	Stone.
Cleveland	W	7	Sand and gravel.
Columbia	41,507	42,476	Bromine, petroleum, natural gas, natural gas liquids, sand and gravel.
Conway	W	W	Stone, natural gas, sand and gravel.
Craighead	W	W	Sand and gravel, clays.
Crawford	4,742	W	Natural gas, sand and gravel, stone.
Crittenden	W	W	Clays, stone, sand and gravel.
Cross	W	254	Sand and gravel, stone.
Dallas	W	22	Sand and gravel.
Desha	W	W	Do.
Drew	W	99	Sand and gravel, stone.
Faulkner	W	W	Stone, sand and gravel.
Franklin	8,904	8,895	Natural gas, coal, stone, sand and gravel.
Fulton	W	187	Stone, sand and gravel.
Garland	W	W	Vanadium, abrasive stone, tripoli, sand and gravel.
Grant	W	W	Sand and gravel.
Greene	W	105	Do.
Hempstead [2]	W	W	Sand and gravel, clays, petroleum.
Hot Spring	W	5,184	Barite, sand and gravel, stone, clays.
Howard	W	9,275	Cement, gypsum, stone, sand and gravel, clays.
Independence	8,064	8,081	Stone, lime, sand and gravel.
Izard	W	2,105	Sand and gravel, stone.
Jackson	W	W	Sand and gravel.
Jefferson	W	482	Do.
Johnson	5,355	5,458	Natural gas, coal, clays, stone.
Lafayette	15,808	15,259	Petroleum, natural gas, sand and gravel, natural gas liquids.
Lawrence	W	W	Stone, sand and gravel.
Lincoln	W	269	Sand and gravel.
Little River	W	W	Cement, stone, clays, sand and gravel.
Logan	W	W	Natural gas, stone, coal.
Lonoke	W	W	Clays, stone, sand and gravel.
Madison	1	W	Stone, sand and gravel.
Marion	W	W	Sand and gravel.
Miller	18,927	18,975	Petroleum, sand and gravel, natural gas, clays, stone.
Mississippi	7	34	Sand and gravel.
Monroe	--	(3)	Do.
Montgomery	W	W	Stone.
Nevada	W	W	Petroleum, sand and gravel.
Newton	2	(3)	Sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Arkansas, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Ouachita	$3,580	$3,769	Petroleum, sand and gravel, natural gas.
Perry	20	W	Stone, sand and gravel.
Phillips	W	W	Sand and gravel.
Pike	W	814	Gypsum, sand and gravel, stone.
Poinsett	341	347	Sand and gravel.
Polk	W	W	Do.
Pope	2,089	W	Stone, natural gas, sand and gravel.
Prairie	--	26	Sand and gravel.
Pulaski	[r] 11,687	11,335	Stone, sand and gravel, clays, bauxite.
Randolph	32	45	Stone, sand and gravel.
St. Francis	W	W	Sand and gravel.
Saline	26,202	22,789	Bauxite, lime, sand and gravel, soapstone, stone.
Scott	W	207	Natural gas, stone, sand and gravel.
Searcy	55	153	Stone, sand and gravel.
Sebastian	5,328	6,066	Natural gas, stone, coal, sand and gravel, clays.
Sevier	61	W	Sand and gravel.
Sharp	11	67	Stone.
Stone	17	W	Stone, sand and gravel.
Union	30,597	31,398	Bromine, petroleum, sand and gravel, natural gas, clays.
Van Buren	W	W	Stone, sand and gravel.
Washington	W	W	Stone, natural gas, sand and gravel.
White	W	W	Stone, sand and gravel.
Woodruff	3	1	Sand and gravel.
Yell	11	22	Natural gas, sand and gravel.
Undistributed [4]	66,954	49,360	
Total [5]	[r] 246,318	241,179	

[r] Revised. W Withheld to avoid disclosing individual company confidential data.

[1] Chicot and Lee Counties are not listed because no production was reported.

[2] Excludes value of petroleum.

[3] Less than ½ unit.

[4] Includes mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[5] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Arkansas business activity

	1971	1972 [p]	Change, percent
Annual labor force and employment:			
Total labor force .... thousands	755.7	792.1	+4.8
Unemployment .... do	41.3	37.1	−10.2
Nonagricultural employment:			
Mining .... do	4.4	4.4	--
Contract construction .... do	27.2	30.8	+13.2
Manufacturing .... do	171.7	184.0	+7.2
Transportation and public utilities .... do	33.5	35.3	+5.4
Wholesale and retail trade .... do	109.3	117.6	+7.6
Finance, insurance, and real estate .... do	22.8	25.6	+12.3
Services .... do	99.9	111.9	+12.0
Government .... do	129.5	139.5	+7.7
Personal income:			
Total .... millions	$6,005	$6,640	+10.6
Per capita	$3,078	$3,357	+9.1
Construction activity:			
Nonresidential construction contracts .... millions	$87.2	$98.4	+12.8
New housing units authorized	11,990	12,706	+6.0
Cement shipments to and within Arkansas .... thousand short tons	840	903	+7.5
Farm marketing receipts .... millions	$1,307.6	$1,485.4	+13.6
Mineral production value .... do	[r] $246.3	$241.2	−2.1

[p] Preliminary. [r] Revised.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; and Federal Bureau of Mines.

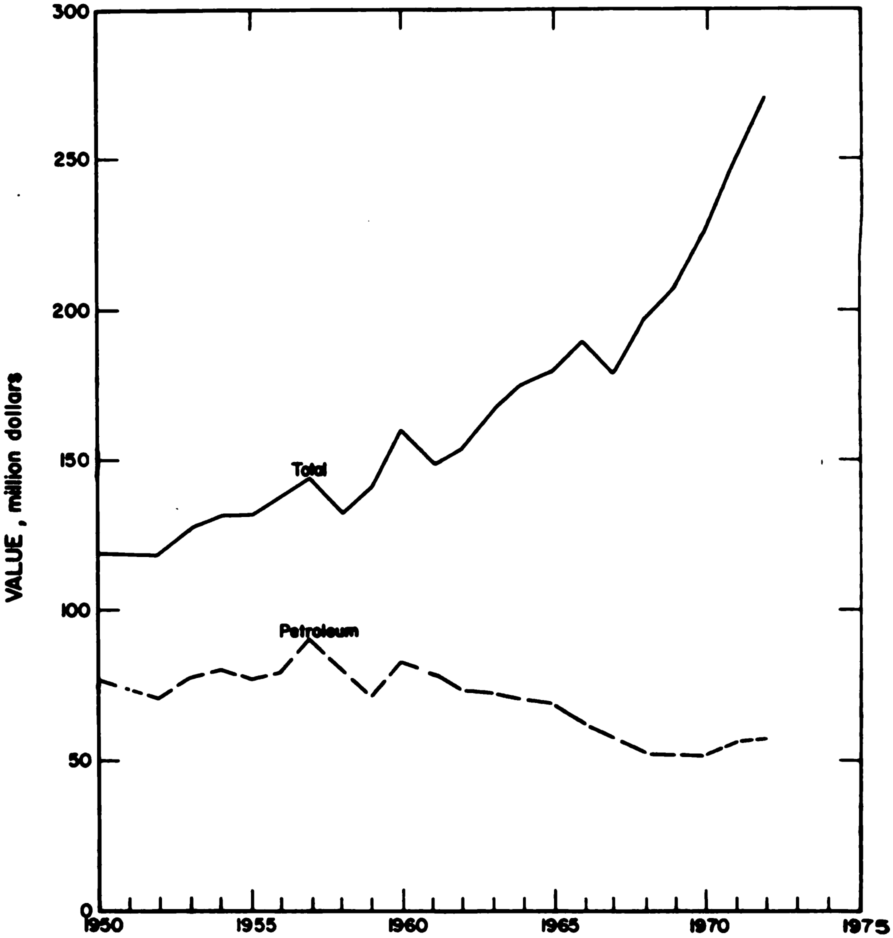

Figure 1.—Value of petroleum and total value of mineral production in Arkansas.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	138	204	28	228	--	6	26.29	NA
Metal	1,300	239	310	2,480	--	42	16.93	1,025
Nonmetal	951	245	233	1,874	--	72	38.42	1,454
Sand and gravel	960	242	232	2,093	--	46	21.98	395
Stone	1,431	276	395	3,320	1	78	23.79	2,439
Total [1]	4,780	251	1,199	9,996	1	244	24.51	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	1,240	239	297	2,395	--	31	12.94	2,727
Nonmetal	655	283	186	1,492	1	27	18.77	4,687
Sand and gravel	400	233	93	867	--	26	30.00	620
Stone	1,035	262	271	2,319	--	72	31.04	2,411
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Value of mineral fuels was $94.1 million, 39% of the total mineral production value. Petroleum remained the most important single contributor to the State's total mineral value. Marketed production of natural gas in 1972 was 166,522 million cubic feet, a decrease of 3.3% from that of the previous year, and 8.2% less than the record high of 181,351 million cubic feet established in 1970. Output of bituminous coal increased to 427,873 short tons from 275,528 short tons produced in 1971.

Carbon Black.—Cities Service Co.'s Columbian Carbon Division El Dorado plant in Union County, the only carbon black plant in the State, continued production for the 21st consecutive year. Output declined 3.7% from that of 1971, and value declined 3.5%. The plant manufactures carbon black by the furnace process using hydrocarbon liquids and natural gas as feedstock.

Coal (Bituminous).—Output of coal totaled 427,873 tons with a value of $4.7 million, compared with 275,528 tons valued at $2.8 million in 1971. Eight bituminous coal mines with output greater than 1,000 tons annually were operated, one more than during the previous year. Of these, one was underground and seven were strip mines. Johnson County, which contains the one underground mine, accounted for about 192,000 tons or nearly 45% of the State's total production. Sebastian County ranked second with production of about 148,000 tons, followed by Franklin County with 84,000 tons, and Logan County with 4,000 tons. Strip mines accounted for 98% of the production.

Table 5.—Arkansas: Bituminous coal production, by type of mine and county, in 1972

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total	
Franklin	--	1	1	--	84	84	W
Johnson	[1] 1	3	4	8	184	192	$2,645
Logan	--	1	1	--	4	4	W
Sebastian	--	2	2	--	148	148	W
Total	1	7	8	8	420	428	4,676

W Withheld to avoid disclosing individual company confidential data; included in "Total."

[1] Mine erroneously reported in Franklin County in 1971.

Preliminary tonnage of coal from coalfields in Arkansas and Oklahoma reported by the Corps of Engineers as having been transported on the McClellan-Kerr Arkansas River Navigation System was 529,327 tons.

Natural Gas.—Marketed production of natural gas decreased from 172,154 million cubic feet in 1971 to 166,522 million cubic feet in 1972. Value in 1972 was $28.8 million, a 2% decrease from that of the previous year.

The dry gasfields of North Arkansas, according to the Arkansas Oil and Gas Commission, marketed 126,003,399,000 cubic feet from 1,063 dry gas wells in the 75 fields in this area in 1972, as compared to 121,112,145,000 cubic feet from 1,041 dry gas wells in 55 gasfields in North Arkansas in 1971. Gas production in North Arkansas came from 10 counties. At the end of 1972, there were 61 gasfields in North Arkansas; four of these had not been connected to a pipeline outlet.

Gas produced with oil in South Arkansas, as reported by the Arkansas Oil and Gas Commission, totaled 44,091,864,000 cubic feet, a decline of 10,633,862,000 cubic feet from the previous year.

Production from North Arkansas was predominantly from Pennsylvanian age sediments; other production was from Silurian, Devonian, and Ordovician sediments. Production from South Arkansas was from Upper and Lower Cretaceous and Jurassic sediments.

According to the American Gas Association, Inc. (AGA), proved reserves of natural gas in Arkansas in 1972 rose by 1% from 2,430,115 million cubic feet to 2,455,877 million cubic feet, thus reversing the trend of the past 4 years.

The seven gas storage reservoirs in North Arkansas, according to the Arkansas Oil and Gas Commission, reported a total of 10,731,531,000 cubic feet of gas in storage as of January 1, 1973.

Table 6.—Arkansas: Gross withdrawals and disposition of natural gas

(Million cubic feet)

Year	Gross withdrawals[1]			Disposition			Vented and wasted[3]
				Marketed production[2]		Repressuring	
	From gas wells	From oil wells	Total	Quantity	Value (thousands)		
1968	110,898	51,257	162,155	156,627	$24,456	4,633	895
1969	119,230	56,105	175,335	169,257	26,743	4,752	1,326
1970	128,241	55,409	183,650	181,351	29,560	2,073	226
1971	120,454	54,429	174,883	172,154	29,426	995	1,734
1972	125,319	43,852	169,171	166,522	28,808	--	2,649

[1] Marketed production plus quantities used in repressuring, vented, and wasted.

[2] Comprises gas sold or consumed by producers, including losses in transmission, quantities added to storage, and increases in gas in pipelines.

[3] Includes direct waste on producing properties and residue blown to air.

Natural Gas Liquids.—Output of natural gas liquids totaled 807,000 barrels valued at $2.3 million, compared with 1,552,000 barrels valued at $4.3 million in 1971. Arkla Chemical Corp. reduced operations at its Hamilton plant in Columbia County because of a decline in supplies of available sour gas. The nearby Magnolia field averaged production of 50 million cubic feet daily in September 1972, but had dropped to 8.5 million cubic feet daily in September 1973. The company estimated that supplies of gas will decrease to 2 million cubic feet daily by the end of 1973. Phillips Petroleum Co. continued to operate its McKamie plant in Lafayette County. A new gas-processing plant, operated by H. A. Chapman, went onstream in the Walker Creek field in Columbia County in 1971. A fourth gas-processing plant is that of O. B. Mobley in the Lewisville field in Lafayette County. Production has been discontinued at Austral Oil Co., Inc.'s Lake Erling plant in Lafayette County, which began operation in 1962; also at Sun Oil Co., DX Division's plants in Lafayette and Miller Counties, which ceased operations in July and April of 1971, respectively.

According to the American Gas Association, Inc. (AGA), proved reserves of natural gas liquids including condensate, natural gasoline, and LP gases were 7.8 million barrels at yearend, compared with 9.6 million barrels the previous year, a decrease of 19.1%.

Petroleum.—Petroleum continued to be the the most significant commodity in the overall mineral value in the State, contributing 24% of the total. Production of 18.5 million barrels represented an increase of 1.4% over the 1971 level. There were 7,191 wells producing from 155 reservoirs in South Arkansas. Oil production came from nine counties: Bradley, Calhoun, Columbia, Hempstead, Lafayette, Miller, Nevada, Ouachita, and Union. All of the South Arkansas fields produced from either Cretaceous or Jurassic formations. Reserves of recoverable crude oil, according to the American Petroleum Institute, were 113.1 million barrels on December 31, 1972, a decrease of 4.5 million barrels from the previous year. Walker Creek Field in Columbia and Lafayette Counties, a prolific Smackover Limestone oil discovery of 1968, was the State's leading oilfield with production of 3.4 million barrels.

Secondary recovery operations continued to play an important role in oil production in Arkansas. Sixty-seven projects were in operation at yearend. They produced 5,285,305 barrels of oil, down 11.3% from the 5,955,517 barrels of oil produced by secondary recovery operations in 1971. During the year, the Arkansas Oil and Gas Commission approved two secondary recovery projects, both of which were waterflood projects.

Table 7.—Arkansas: Crude petroleum production, indicated demand, and stocks in 1972, by month

(Thousand 42-gallon barrels)

Month	Production	Indicated demand	End-of-month stocks originating within Arkansas
January	1,521	1,709	671
February	1,468	1,426	708
March	1,570	1,581	697
April	1,528	1,505	715
May	1,582	1,595	702
June	1,581	1,509	724
July	1,584	1,488	870
August	1,577	1,571	876
September	1,526	1,542	860
October	1,588	1,809	639
November	1,501	1,545	595
December	1,558	1,485	663
Total:			
1972	18,519	18,715	XX
1971	18,268	18,091	XX

XX Not applicable.

There were 428 saltwater disposal wells in operation during 1972 that disposed of 136.3 million barrels of saltwater. An additional 42.9 million barrels of water (including 10.7 million barrels of water from sources other than the zones being flooded) were injected for secondary recovery purposes. A total of 182.9 million barrels of saltwater produced with oil and gas (including 3.7 million barrels of water produced in Magnolia field that was sold to a bromine processing plant) was injected underground. This represented 84.2% of the total water produced. The remaining 15.8% of the water produced was disposed of into surface facilities.

Petroleum and Natural Gas Exploration and Development.—Total number of well completions in Arkansas, according to the American Petroleum Institute, increased from 342 wells in 1971 to 344 wells in 1972. Of the 344 wells drilled, 96 were completed as oil wells, 39 as gas wells, and 209 as dry holes. Overall success ratio was 39%; about 9% of the exploratory wells were completed as oil and gas producers.

According to the 1972 Annual Oil and Gas Report of the Arkansas Oil and Gas Commission, six new fields, one rediscovery, and six new reservoirs resulted from drilling during the year. All of the new fields, the rediscovery, and the new reservoirs were oil producers located in South Arkansas.

The six new fields were the Corinth Church field in Columbia County, the Bois D'Arc Creek field in Hempstead County, the Days Creek and Four Mile Creek fields in Miller County, and the Cornie Creek and O'Brien fields in Union County. The one rediscovery was the Beech Creek field

Table 8.—Arkansas: Oil and gas well drilling completions, by county, in 1972

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Ashley	--	--	--	--	--	2	2	8,550
Bradley	2	--	--	--	--	3	5	18,271
Calhoun	--	--	1	--	--	2	3	10,795
Columbia	30	1	14	2	1	14	62	476,181
Crawford	--	5	1	--	--	--	6	37,753
Crittenden	--	--	--	--	--	2	2	6,947
Drew	--	--	--	--	--	1	1	5,018
Franklin	--	4	2	--	--	--	6	30,552
Hempstead	--	--	2	1	--	3	6	39,532
Johnson	--	7	9	--	--	--	16	90,856
Lafayette	14	1	20	--	--	8	43	297,040
Lee	--	--	--	--	--	1	1	14,855
Little River	--	--	--	--	--	1	1	1,851
Logan	--	1	--	--	--	--	1	8,207
Lonoke	--	--	--	--	--	1	1	1,572
Miller	4	1	4	2	--	10	21	159,598
Nevada	8	--	9	--	--	12	29	104,944
Ouachita	15	--	21	--	--	13	49	167,419
Poinsett	--	--	--	--	--	1	1	1,691
Pope	--	6	1	--	--	--	7	31,995
Sebastian	--	11	5	--	--	1	17	132,598
Union	16	1	27	2	--	17	63	291,951
Yell	--	--	--	--	--	1	1	9,861
Total	89	38	116	7	1	93	344	1,942,987

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

in Union County. Two new pool discoveries were established in Columbia County, one in Miller County, two in Ouachita County, and one in Union County.

The most significant discovery was the Days Creek field, located about 7 miles south of Texarkana in Miller County. The discovery well, American Petrofina Co. of Texas—Gifco Properties, Inc., No. 1, in Sec. 33, T. 16 S., R. 28 W., was completed to a total depth of 8,410 feet. Initial production from 8,235 feet to 8,250 feet (Smackover Formation) was recorded as flowing 330 barrels of oil per day of 45° API gravity crude through a 10/64-inch choke. Four additional producing wells and three dry holes had been completed in the field at yearend.

Production in Hempstead County was resumed with the discovery of the Bois D'Arc field in Sec. 24, T. 14 S., R. 25 W. The discovery well, Belco Petroleum Corp.'s No. 1 E. B. Bobo, was drilled to a total depth of 6,071 feet. Initial production (Smackover Formation) was recorded as pumping 45 barrels of oil per day of 30° API gravity crude. The only other oilfield in the county, the Patmos field discovered in 1966, was abandoned in 1971.

Petroleum Refineries.—Arkansas had six petroleum refineries in operation at the beginning of 1972. In March, however, the American Oil Co. closed its El Dorado refinery and deeded the property to Union County and the city of El Dorado for an industrial park. The company had piped in crude oil from Texas to maintain the plant for a while, but that effort failed as expenses mounted. El Dorado's other oil-producing facility, the Lion Oil Co. refinery, was sold by Monsanto Chemical Corp. to the Oil Shale Corp. (TOSCO); the trademark and corporation identity of Lion Oil Co. will continue to be used by TOSCO.

Other refineries in the State were as follows: MacMillan Ring-Free Oil Co.'s refinery at Norphlet, Union County; the refinery of Cross Oil and Refining Co. of Arkansas at Smackover, Union County; and Berry Petroleum Co.'s plants at Waterloo, Nevada County, and Stephens, Ouachita County. The Waterloo plant, however, was closed by Berry Petroleum Co. at the end of the year. High labor costs, curtailment of gas supplies, uncertain rail service, and necessity for heavy capital outlay to meet environmental control regulations were factors that contributed to the closing of the refinery. The company plans to enlarge capacity at its Stephens plant to 3,300 barrels per day.

Table 9.—Arkansas: Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Proved reserves Dec. 31, 1971	Changes in proved reserves due to revisions, extensions and discoveries in 1972	Proved reserves Dec. 31, 1972 (Production deducted)	Changes from 1971 (percent)
Crude oil........thousand barrels..	117,648	13,733	118,100	−8.9
Natural gas liquids..........do....	9,619	(−358)	7,778	−19.1
Natural gas.....million cubic feet..	2,430,115	194,734	2,455,877	+1.1

Source: American Petroleum Institute and American Gas Association, Inc.

NONMETALS

A major part of the total Arkansas mineral value in 1972 was contributed by a wide variety of nonmetallic minerals.

Abrasive Stone.—Novaculite for oilstones was produced by seven operators: Arkansas Abrasives, Inc., Arkansas Oilstone Co., Inc., John O. Glassford, Cleve Milroy, Norton Pike Division of Norton Co., Hiram A. Smith, and W. V. Smith, all from operations in Garland County. Volume and value decreased 12% and 18%, respectively, from those of 1971.

Barite.—Barite tonnage and value increased 5% and 16%, respectively, over 1971. NL Industries, Inc., Baroid Division, and Dresser Minerals mined and processed ore in Hot Spring County. Barite mined in Missouri was processed by The Milwhite Co., Inc., at Bryant, Saline County. All of the barite was used in making drilling muds. For the fifth consecutive year, the State ranked third in the United States in barite output.

Bromine.—Five plants, two in Columbia County and three in Union County, extracted bromine from brine found in the Smackover Limestone of Jurassic age. Output and value increased 17.1% and 7.8%, respectively, over that of 1971, and the State continued to rank first in production of bromine in the United States. For the fourth consecutive year, bromine was the second most important mineral commodity in value to the State. According to the Arkansas Oil and Gas Commission, 149,304,460 barrels of saltwater, was produced in 1972 for processing bromine. The plants disposed of 164,234,908 barrels of effluent, which is 10% more liquids than they take in. The effluent was injected into 28 saltwater disposal wells that are completed in the Smackover Limestone.

Table 10.—Arkansas: Bromine compounds sold or used by primary producers

(Thousand pounds and thousand dollars)

Year	Quantity		Value
	Gross weight	Bromine content	
1970................	186,118	157,006	32,875
1971................	199,429	168,198	34,426
1972................	233,011	195,949	40,571

Cement.—Portland and masonry cement shipped by the State's two producers decreased 7.6% in quantity and 4.5% in value. Over 94% of the cement shipped was portland cement. Raw materials used in making portland cement included limestone, clay, and gypsum. Most of the cement shipments were by truck in bulk form.

Consumption of portland cement in Arkansas totaled 829,717 tons. It was consumed by ready-mix concrete companies (62%), concrete product manufacturers (10%), building material dealers (3%), and contractors and other users (25%). Masonry cement consumed in the State totaled 64,371 tons.

Arkansas Cement Corp. was installing three electrostatic precipitators at its plant in Foreman, Little River County. Ideal Cement Co., a division of Ideal Basic Industries, Inc., filed a completion report with State environmental control authorities on the air pollution program for the firm's plant at Okay, Howard County. The newly completed pollution control equipment included two electrostatic precipitators, new stacks on the plant kilns, and a bag-type dust collector for the plant dryer.

Clays.—Clay production was reported from 13 counties. Total clay output decreased both in quantity and value from that of 1971. Quantity and value of common clay decreased 5.4% and 34%, respectively. Kaolin decreased slightly in quantity and 2.2% in value. The five leading clay producing counties (Hot Spring, Lonoke, Pulaski, Crittenden, and Little River) accounted for nearly 74% of the total production. Common clay was used for manufacture of face brick, sewer pipe, and cement; one company produced lightweight aggregate at two plants (England and West Memphis). Kaolin was used for chemicals and refractory products.

Gem Stones.—Small quantities of gem stones and mineral specimens continued to be collected in Arkansas. Estimated value of material found in 1972 increased about 7% over that of the previous year.

The Crater of Diamonds mine near Murfreesboro was acquired in March by the Arkansas Department of Parks and Tourism. The property continued to be operated as a tourist attraction for those who wish to hunt for diamonds. A 1.76 carat silver-white diamond was among those reported found in 1972.[2]

Gypsum.—Output of crude gypsum increased 18% over that of 1971. The State's two producing companies—Dulin Bauxite Co., Inc. in Pike County and Weyerhaeuser Co. in Howard County—mined and processed gypsum for use in cement and wallboard manufacturing, respectively.

A new $4.5 million gypsum wallboard manufacturing plant at West Memphis, Crittenden County, started operations in the spring of 1972. The new facility is known as Temple Gypsum, a subsidiary of Temple Industries of Diboll, Tex. The plant uses crude gypsum mined in Oklahoma and has the capacity to produce 180 million square feet of gypsum wallboard annually.

Lime.—Rangaire Corp. produced lime in Independence County for paper and pulp, soil stabilization, and other uses. Reynolds Metals Corp., a subsidiary of Reynolds

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[2] Arkansas Gazette, July 30, 1972.

Table 11.—Arkansas: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Commercial operations:				
Sand:				
Building	1,947	2,752	2,641	4,359
Fill	164	122	341	365
Paving	2,050	2,122	1,808	2,096
Other uses [1]	457	1,168	405	1,071
Total [2]	4,618	6,164	5,194	7,893
Gravel:				
Building	1,862	3,809	2,029	3,696
Fill	22	27	115	194
Paving	2,837	3,254	2,552	3,158
Railroad ballast	W	W	([3])	([3])
Miscellaneous	332	371	113	103
Other uses	179	367	--	--
Total [2]	5,232	7,828	4,809	7,152
Government-and-contractor operations:				
Sand:				
Building	3	2	--	--
Fill	--	--	72	73
Paving	713	697	688	554
Total [2]	716	699	759	628
Gravel:				
Fill	--	--	8	9
Paving	1,058	911	741	840
Other uses	5	1	62	37
Total	1,063	912	811	886
Total sand and gravel [2]	11,630	15,603	11,574	16,558

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes ground and unground sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Less than ½ unit.

Table 12.—Arkansas: Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total[1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1968	10,682	12,795	2,315	1,848	12,997	14,643
1969	10,067	12,919	2,608	2,030	12,674	14,949
1970	10,639	13,553	2,662	2,484	13,301	16,036
1971	9,850	13,998	1,779	1,611	11,630	15,608
1972	10,004	15,045	1,571	1,514	11,574	16,558

[1] Data may not add to totals shown because of independent rounding.

Metals Co., and Aluminum Co. of America (Alcoa) produced lime in Saline County for processing bauxite to alumina. Output decreased 4% and was 27% below the 1966 record. The lime was consumed in Arkansas, Louisiana, Tennessee, and other States. Total consumption of lime in Arkansas was 152,044 tons.

Sand and Gravel.—Production of sand and gravel remained about the same, but value increased 6% over that of 1971. Pulaski County led the State in production, followed by Miller, Crawford, Hot Spring, Craighead, Calhoun, Lafayette, and Jefferson Counties. Collectively, these eight counties accounted for 46% of the total tonnage. Most of the production was used for highway construction and building.

The Sheridan White Rock Co., 12 miles south of Sheridan near Jenkins Ferry State Park on the Saline River, produced a white gravel and sand for which demand has been increasing not only in Arkansas but throughout the country. The company ships sand and rock by truck and rail into 22 States. The deposit covers about 250 acres and about one-third of it has been mined. Since leasing the land in 1960, the company has tripled its production. Up to 750 tons of gravel can be mined, washed, graded, and made ready for shipment in a normal day. Most of the white rock goes to the building industry for landscape beautification.[3]

Soapstone.—Arkansas' only producer of soapstone, The Milwhite Co., Inc., increased output 3% in 1972. This was the 20th consecutive year of production from Saline County, where the soapstone is mined and processed. Most of the material was ground for use in roofing, insecticides, and rubber.

Stone.—Output of all stone produced in Arkansas in 1972 was 16.3 million tons, valued at $25,020,000. Types of stone quarried included sandstone, granite (syenite), limestone, dolomite, slate, quartzite, and marble. Stone ranked fourth in value of State mineral production, accounting for 10.4% of total value.

Sandstone output of 5.7 million tons (valued at $9.0 million) accounted for 35% of the stone production; 64% of the sandstone production was from four counties (White, Sebastian, Pope, and Crawford). Dimension sandstone was produced by three companies in Logan County and one company in Independence County. All of the granite (syenite) produced was from Pulaski County. Crushed and broken limestone represented about 29% of the State's stone production; the leading limestone producing counties were: Little River, Izard, Washington, Independence, and Howard. Dolomite was produced in Lawrence and Sharp Counties. Slate was produced in Montgomery and Saline Counties. Quartzite was produced in Hot Spring County. Dimension marble was produced in Independence County.

Principal uses of stone were for road base stone, riprap and jetty stone, cement, roofing aggregate, concrete aggregate, railroad ballast, and flux stone.

Eighty-six quarries supplied the various stone types.

Sulfur (Recovered Elemental).—As a pollution control measure, Bromet Co. at its Magnolia bromine extraction plant in Columbia County continued to recover sulfur released from hydrogen sulfide during the processing of brines. Three other plants treated sour gas for sulfur recovery. These were Arkla Chemical Corp. at its Hamilton plant in Columbia County, Phillips Petroleum Co. (formerly Olin Corp.) at its McKamie plant in Lafayette County, and Lion Oil Co. (formerly Monsanto Chemical Corp.), at its El Dorado refinery in Union County. Output from the four plants was 25,029 long tons valued at $365,111.

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[3] Arkansas Gazette. Mar. 12, 1972.

Tripoli.—Output of tripoli decreased 27.5% in 1972, but value increased 21.8%. Malvern Minerals Co. continued to operate its open pit mine in Garland County. Hercules Minerals Corp., however, ceased operations at its open pit mine in Pike County. The tripoli was used for abrasives and filler.

Vermiculite.—Crude vermiculite, mined outside the State, was processed by Strong-Lite Products at its Pine Bluff plant in Jefferson County and by Construction Products Div., W. R. Grace & Co. at its North Little Rock plant in Pulaski County. The exfoliated material was used for concrete aggregate, plaster aggregate, loose fill insulation, and other uses.

METALS

Aluminum.—Reynolds Metals Co., the only producer of aluminum from alumina in Arkansas, operated its two reduction plants, Jones Mills at Malvern, Hot Spring County and Robert P. Patterson at Arkadelphia, Clark County. Aluminum metal was rolled, extruded, and drawn into various semifabricated shapes at several plants.

Alumina was produced at Reynolds Metals Co.'s Hurricane Creek plant and Alcoa's plant near Bauxite, Saline County. Both companies have spent considerable sums for air pollution control devices at these two plants. Presumably, dust precipitators now installed and facilities to be added will reduce dust emissions at least 98%. All precipitators are to be fully operable by the end of 1973. The companies are said to be developing the technology and are "pioneering" in the field of antipollution devices.

Bauxite.—Output and value of bauxite decreased 8% and 16%, respectively, from that of 1971. There were four crude bauxite producers during 1972: Reynolds Mining Corp., Alcoa, American Cyanamid Co., and A. P. Green Refractories Co. Most of the bauxite was mined in Saline County, but there also was production from Pulaski County. Reynolds Mining Corp., operated both an underground and an open pit mine; the other companies produced from open pit operations. Arkansas continued to rank first among the States in bauxite production with 90% of the U.S. total.

Gallium.—Alcoa, which extracts gallium from alumina refinery solutions, expects to complete a $1 million expansion of its gallium extraction plant at Bauxite by mid-1974.

Vanadium.—Production of vanadium ore, mined by Union Carbide Corp. at Wilson Springs, Garland County, increased over that of 1971. Recovery of vanadium at the company's Wilson Springs plant also increased. In 1972, Arkansas surpassed Colorado as the leading State in production of vanadium.

Table 13.—Arkansas: Mine production of bauxite and shipments from mines and processing plants to consumers in the United States

(Thousand long tons and thousand dollars)

Year	Mine production			Shipments from mines and processing plants to consumers		
	Crude	Dry equivalent	Value [1]	As shipped	Dry equivalent	Value [1]
1968	1,961	1,582	23,058	1,962	1,680	25,349
1969	2,116	1,755	24,706	2,044	1,765	26,304
1970	2,251	1,869	26,293	2,194	1,917	29,049
1971	2,157	1,781	24,979	2,161	1,892	28,296
1972	1,973	1,634	21,010	2,128	1,844	25,426

[1] Computed from selling prices and values assigned by producers and from estimates of the Bureau of Mines.

Table 14.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasive:			
Arkansas Abrasives, Inc	P.O. Box 1298 Hot Springs, Ark. 71901	Mine and plant	Garland.
Norton Pike Division, Norton Co.	Littleton, N.H. 03561	Mine	Do.
Hiram A. Smith Whetstone Co.	11 Snider St. Hot Springs, Ark. 71901	do	Do.
Barite:			
Dresser Minerals	P.O. Box 6504 Houston, Tex. 77005	Mine and plant	Hot Spring.
NL Industries, Inc	P.O. Box 1675 Houston, Tex. 77001	do	Do.
Bauxite:			
Aluminum Co. of America	1501 Alcoa Bldg. Pittsburgh, Pa. 15219	Mine	Saline.
American Cyanamid Co	Berdan Avenue Wayne, N.J. 07470	Mine and plant	Do.
A. P. Green Refractories Co.	Mexico, Mo. 65265	Mine	Pulaski.
Reynolds Mining Corp	P.O. Box 398 Bauxite, Ark. 72011	do	Saline.
Bromine:			
Arkansas Chemicals, Inc	Route 6, Box 98 El Dorado, Ark. 71730	Brine wells and plant.	Union.
Bromet Co	P.O. Box B Magnolia, Ark. 71753	do	Columbia.
The Dow Chemical Co	Midland, Mich. 48640	do	Do.
Great Lakes Chemical Corp.	P.O. Box 2200, West Lafayette, Ind. 47901	do	Union.
Michigan Chemical Corp	351 East Ohio St. Chicago, Ill. 60611	do	Do.
Carbon black:			
Cities Service Co., Columbian Division.	60 Wall St. New York, N.Y. 10005	Furnace	Do.
Cement:			
Arkansas Cement Corp	P.O. Box 398 Foreman, Ark. 71836	Plant and quarry	Little River.
Ideal Cement Co., Div. of Ideal Basic Industries Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Howard.
Clays:			
Acme Brick Co	P.O. Box 425 Fort Worth, Tex. 76101	Mine and plant	Hot Spring and Sebastian.
Arkansas Cement Corp	P.O. Box 398 Foreman, Ark. 71836	do	Little River.
Arkansas Lightweight Aggregate Corp.	P.O. Box 99 England, Ark. 72046	do	Crittenden and Lonoke.
W.S. Dickey Clay Manufacturing Co.	P.O. Box 13125 Kansas City, Mo. 64199	do	Miller.
Eureka Brick & Tile Co	Clarksville, Ark. 72830	do	Johnson.
A.P. Green Refractories Co	Mexico, Mo. 65265	do	Pulaski.
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg Denver, Colo. 80202	do	Howard.
Coal:			
Farrell Mining Co	P.O. Box 168 Mansfield, Ark. 72944	Strip mine	Sebastian.
Garland Coal & Mining Co	P.O. Box 186 Fort Smith, Ark. 72901	do	Franklin and Johnson.
Peabody Coal Co	301 N. Memorial Dr. St. Louis, Mo. 63102	do	Johnson.
Prairie Coal Co., Inc	415 Grandview Ave. Clarksville, Ark. 72830	Underground mine	Do.
Gypsum:			
Dulin Bauxite Co., Inc	835 Valley Hot Springs, Ark. 71901	Mine and plant	Pike.
Weyerhaeuser Co	Route 4, Box 78 Nashville, Ark. 71852	do	Howard.
Lime:			
Aluminum Co. of America	1501 Alcoa Bldg. Pittsburgh, Pa. 15219	Plant	Saline.
Rangaire Corp., Batesville White Lime Division.	P.O. Box 1311 Batesville, Ark. 72501	do	Independence.
Reynolds Metals Co	6603 W. Broad Street Richmond, Va. 23226	do	Saline.
Natural gas liquids:			
Arkla Chemical Corp., subsidiary of Arkansas Louisiana Gas Co.	Magnolia, Ark. 71753	do	Columbia.
Phillips Petroleum Co	Stamps, Ark. 71860	do	Lafayette.
Petroleum refineries:			
Berry Petroleum Co., Div. Crystal Oil Co.	Magnolia, Ark. 71753	2 Refineries	Nevada and Ouachita.

Table 14.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum refineries—Continued:			
Cross Oil & Refinery Co. of Arkansas, Div. C.J. Wood Petroleum Co.	Smackover, Ark. 71762	Refinery	Union.
Lion Oil Company	El Dorado, Ark. 71730	do	Do.
Macmillan Ring-Free Oil Co., Inc.	Norphlet, Ark. 71759	do	Do.
Roofing granules:			
Bird and Son, Inc	East Walpole, Mass. 02032	Plant	Montgomery.
Minnesota Mining and Manufacturing Company	3 M Center (220-13W) St. Paul, Minn. 55101	do	Puaski.
Sand and gravel:			
Arkansas Rock & Gravel Co.	P.O. Box 158 Murfreesboro, Ark. 71958	Stationary	Clark, Hempstead, Howard, Nevada, Pike, Polk.
Arkhola Sand & Gravel Co.	823 Merchants Bank Bldg. Fort Smith, Ark. 72901	do	Crawford.
Belvedere Sand & Gravel Co.	Box 421 Hot Springs, Ark. 71901	do	Hot Spring.
Criss & Shaver Inc.	1818 Worthern Bank Bldg. Little Rock, Ark. 72201	Dredge	Pulaski.
Gifford-Hill & Company, Inc.	P.O. Box 47127 Dallas, Tex. 75247	Stationary	Lafayette and Miller.
Hill Sand & Gravel Co., Inc.	P.O. Box 47127 Dallas, Tex. 75247	do	Saline.
Jeffrey Sand Co	P.O. Box 5054, North Little Rock, Ark. 72114	do	Pulaski.
Mobley Construction Co., Inc.	P.O. Box 109 Morrilton, Ark. 72110	Portable	Jackson and Polk.
St. Francis Material Co	P.O. Box 999 Forrest City, Ark. 72335	Stationary	Ashley, Calhoun, Craighead, Poinsett, St. Francis.
Silica Products Co., Inc	P.O. Box 248 Guion, Ark. 72540	do	Izard.
Stone:			
Arkansas Cement Corp	P.O. Box 398 Foreman, Ark. 71836	Quarry	Little River.
Arkhola Sand & Gravel Co.	823 Merchants Bank Bldg. Fort Smith, Ark. 72901	do	Crawford, and Sebastian.
Freshour Construction Co.	P.O. Box 77 Sweethome, Ark. 72164	do	Franklin, Fulton, Lonoke, Pope, Stone, Van Buren, White.
Ben M. Hogan Co., Inc	P.O. Box 2860 Little Rock, Ark. 72203	do	Lawrence, Pope, Sharp, White.
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Howard.
McClinton Brothers Co	P.O. Box 1367 Fayetteville, Ark. 72701	do	Madison and Washington.
McGeorge Contracting Co.	P.O. Box 248 Pine Bluff, Ark. 71601	do	Pulaski.
Minnesota Mining and Manufacturing Company	3 M Center (220-13 W) St. Paul, Minn. 55101	do	Do.
Rangaire Corp	P.O. Box 1311 Batesville, Ark. 72501	do	Independence and Izard.
Southern Constr. Co., Inc.	4345 Asher Station Little Rock, Ark. 22204	do	Sebastian.
Sulfur (recovered):			
Arkla Chemical Corp., subsidiary of Arkansas Louisiana Gas Co.	P.O. Box 9 Magnolia, Ark. 71753	Byproduct sulfur recovery.	Columbia.
Bromet Co	Box B Magnolia, Ark. 71753	do	Do.
Phillips Petroleum Co	Box 30 Bartlesville, Okla. 74004	do	Lafayette.
Lion Oil Company	El Dorado, Ark 71730	do	Union.
Talc and soapstone:			
The Milwhite Co., Inc	P.O. Box 15038 Houston, Tex. 77020	Mine and plant	Saline.
Tripoli:			
Malvern Minerals Co	P.O. Box 1246 Hot Springs, Ark. 71901	Mine	Garland.
Vanadium:			
Union Carbide Corp	Route 2, Box 563 Hot Springs, Ark. 71901	Mine and mill	Do.
Vermiculite, exfoliated:			
Constr. Products Div., W. R. Grace & Co.	62 Whittemore Avenue Cambridge, Mass. 02140	Processing plant	Pulaski.
Strong-Lite Products	P.O. Box 8068-Hwy. 79 North Pine Bluff, Ark. 71601	do	Jefferson.

The Mineral Industry of California

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the California Department of Conservation, Division of Mines and Geology, for the collection of mineral data.

By Walter C. Woodmansee [1]

For the first time since 1960, total value of mineral production in California declined, following the record high of 1971. Although unit prices were higher for a number of mineral commodities, a lower level of activity for several minerals led to decreased values.

A large variety of minerals was produced in the State. Among them, California was of national prominence as a producer of crude petroleum and petroleum refinery products, natural gas, asbestos, boron minerals, cement, construction materials (clays, sand and gravel, stone), diatomite, magnesium compounds, rare-earth (bastnaesite) concentrate and metals, and tungsten concentrate.

During 1972, significant increases in output were recorded for nonmetals including asbestos, boron, diatomite, gypsum, magesium compounds, pumice, sand and gravel, and talc, and, among the metals, for copper, gold, molybdenum concentrate, rare earth minerals and metals, and tungsten concentrate.

Output of crude oil, which was by far the most important product in terms of output value, accounting for half the total value, continued in a decline. Similarly, value of natural gas output, which accounted for an additional 10% of total value, also was lower. Significant decreases were also recorded for bromine, calcium compounds, cement, clays, feldspar, lithium compounds, potash, salt, stone, iron ore, lead, mercury, silver, and zinc.

Oil and gas exploration was adversely affected by more stringent regulations concerning the environment, particularly in State and Federal offshore areas, where potential for new reserves was considered good. A few oil and gas discoveries were announced, but none was of sufficient importance to reverse the downward trend in production and reserves.

New facilities were installed or under construction to meet environmental standards at several operations. In the petroleum industry, progress was made in practices for combatting oil spills in coastal waters and in rehabilitation of land oil sumps. Dust abatement was of continuing concern at operations for asbestos, boron, cement, clays, diatomite, gypsum, magnesium compounds, sand and gravel, and stone.

Legislation and Government Programs[2].—The following principal legislation directly or indirectly affecting the mineral industry in California was passed by the 1972 Regular Session of the State Legislature and signed into law by the Governor, effective March 7, 1973 (61 days after final adjournment of the Legislature):

Assembly Bill (AB) 901—Provided revisions to State mining law; eliminated requirement for location work on lode and placer mining claims, thereby reducing surface damage; sought better property descriptions by requiring that affidavits for labor performed and property improvement show location by section, township, range, and meridian; decreased incidence of claim falsification by ruling willful false statement a misdemeanor.

AB 2064—Established State mining and minerals policy; authorized State Geologist to conduct investigations in mining and

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[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

[2] Compiled largely from data provided by William H. Kerns, Bureau of Mines Liaison Officer, Sacramento, Calif. Legislation and programs relating to a specific mineral commodity are cited in the appropriate subsection of the Review of Mineral Commodities section of this chapter.

Table 1.—Mineral production in California [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Asbestos short tons	87,144	$7,806	90,967	$8,673
Barite thousand short tons	W	W	4	34
Boron minerals do	1,047	89,856	1,121	95,882
Cement:				
Portland do	9,117	169,921	9,086	182,808
Masonry do	(2)	(2)	W	W
Clays do	[3] 2,822	[3] 7,103	2,706	7,387
Copper (recoverable content of ores, etc.) short tons	515	536	598	612
Gem stones	NA	205	NA	215
Gold (recoverable content of ores, etc.) troy ounces	2,966	122	3,974	233
Gypsum thousand short tons	1,352	3,884	1,525	4,965
Lead (recoverable content of ores, etc.) short tons	2,284	630	1,153	347
Lime thousand short tons	630	10,846	608	13,059
Magnesium compounds from sea-water bitterns (partly estimated) short tons MgO equivalent	152,918	16,836	175,654	18,421
Mercury 76-pound flasks	[r] 13,489	[r] 3,945	5,788	1,268
Natural gas million cubic feet	612,629	199,717	487,278	179,318
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	11,045	35,545	8,468	27,664
LP gases do	6,755	16,482	5,847	15,962
Peat thousand short tons	12	W	29	620
Petroleum (crude) thousand 42-gallon barrels	358,484	975,076	347,022	940,430
Pumice thousand short tons	699	1,179	731	1,507
Salt do	1,887	21,142	1,621	14,860
Sand and gravel do	115,468	157,683	117,288	162,619
Silver (recoverable content of ores, etc.) thousand troy ounces	444	686	175	296
Stone thousand short tons	43,336	86,255	37,213	65,811
Talc, pyrophylite, and soapstone short tons	153,227	2,084	155,155	1,186
Zinc (recoverable content of ores, etc.) short tons	3,003	967	1,202	427
Value of items that cannot be disclosed: Barite, bromine, calcium-magnesium chloride, carbon dioxide, clays (fuller's earth and ball), coal (lignite), diatomite, feldspar, iron ore, lithium minerals, molybdenum, perlite, potassium salts, rare-earth minerals, sodium carbonate, sodium sulfate, tungsten, concentrates and values indicated by symbol W	XX	112,218	XX	107,266
Total	XX	[r] 1,920,723	XX	1,851,365
Total 1967 constant dollars	XX	1,633,191	XX	[p] 1,540,151

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Less than ½ unit.

[3] Excludes ball clay and fuller's earth; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in California, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Alameda	$27,232	$26,683	Sand and gravel, salt, stone, clays, petroleum.
Alpine	W	W	Silver, gold, sand and gravel, lead, stone, zinc, copper.
Amador	2,665	5,149	Sand and gravel, stone, coal, clays.
Butte	3,014	W	Natural gas, sand and gravel.
Calaveras	17,807	17,966	Cement, asbestos, stone, clays, sand and gravel.
Colusa	3,578	3,419	Natural gas, sand and gravel, stone.
Contra Costa	14,330	10,760	Natural gas, stone, petroleum, lime, clays, sand and gravel, peat.
Del Norte	319	649	Stone, sand and gravel, gold.
El Dorado	2,672	2,596	Stone, lime, sand and gravel, talc.

See footnotes at end of table.

Table 2.—Value of mineral production in California by county—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Fresno	$52,525	$49,548	Petroleum, sand and gravel, natural gas, asbestos, natural gas liquids, stone, gold, clays.
Glenn	5,610	W	Natural gas, sand and gravel, lime.
Humboldt	2,078	W	Natural gas, sand and gravel, stone.
Imperial	6,048	4,673	Gypsum, lime, sand and gravel, stone, clays.
Inyo	20,217	18,398	Tungsten, talc, boron, molybdenum, copper, zinc, sand and gravel, lead, silver, stone, perlite, clays, gold.
Kern	480,790	469,442	Petroleum, boron, cement, natural gas, natural gas liquids, stone, sand and gravel, gypsum, salt, clays, pumice.
Kings	8,423	7,734	Natural gas, natural gas liquids, petroleum, sand and gravel, stone.
Lake	865	W	Sand and gravel, pumice, stone, mercury.
Lassen	W	W	Stone, sand and gravel, pumice.
Los Angeles	369,019	346,126	Petroleum, sand and gravel, natural gas, natural gas liquids, stone, lime, clays, gold.
Madera	1,381	1,530	Natural gas, sand and gravel, pumice, stone.
Marin	2,757	2,357	Stone, clays, mercury, sand and gravel.
Mariposa	411	81	Sand and gravel, stone.
Mendocino	W	587	Do.
Merced	3,146	1,658	Sand and gravel, gold.
Modoc	W	938	Peat, sand and gravel, stone, pumice.
Mono	221	528	Sand and gravel, pumice, clays, talc, gold.
Monterey	52,122	54,351	Petroleum, magnesium compounds, lime, sand and gravel, stone, feldspar, natural gas.
Napa	4,220	3,082	Stone, salt, mercury, diatomite, clays, sand and gravel.
Nevada	1,146	1,876	Sand and gravel, stone, pumice.
Orange	110,720	121,489	Petroleum, sand and gravel, natural gas, natural gas liquids, clays, lime, stone.
Placer	1,195	2,027	Sand and gravel, clays, stone, gold.
Plumas	W	W	Stone, pumice, gold.
Riverside	61,024	60,262	Iron ore, cement, sand and gravel, stone, clays, petroleum, natural gas.
Sacramento	20,990	23,023	Natural gas, sand and gravel, stone, gold, clays.
San Benito	11,143	14,135	Cement, stone, asbestos, sand and gravel, mercury, petroleum, clays, natural gas.
San Bernardino	146,932	151,694	Cement, boron minerals, sodium carbonates and sulfates, stone, sand and gravel, potassium salts, rare-earth minerals, iron ore, salt, clays, lime, petroleum, calcium chloride, talc, pumice, lithium minerals, tungsten, natural gas, gypsum.
San Diego	26,901	25,446	Sand and gravel, stone, salt, magnesium compounds, clays, copper, gold, feldspar, silver.
San Francisco	W	W	Sand and gravel.
San Joaquin	19,453	21,995	Natural gas, sand and gravel, stone, lime, gold.
San Luis Obispo	7,898	7,619	Petroleum, stone, sand and gravel, natural gas, mercury, clays.
San Mateo	18,937	8,825	Magnesium compounds, stone, salt, sand and gravel, petroleum, natural gas.
Santa Barbara	103,284	126,479	Petroleum, diatomite, cement, natural gas liquids, sand and gravel, lime, stone, mercury.
Santa Clara	44,973	W	Sand and gravel, stone, mercury.
Santa Cruz	W	11,426	Cement, sand and gravel, stone, feldspar, clays.
Shasta	6,993	7,076	Cement, sand and gravel, stone, clays, pumice, barite, gold.
Sierra	38	13	Sand and gravel, gold.
Siskiyou	W	873	Sand and gravel, stone, pumice.
Solano	29,608	27,407	Natural gas, stone, sand and gravel.
Sonoma	5,947	5,935	Sand and gravel, stone, mercury, natural gas, clays.
Stanislaus	2,224	2,846	Sand and gravel, stone, gold, clays.
Sutter	12,977	11,472	Natural gas, sand and gravel, clays, pumice.
Tehama	1,830	1,808	Natural gas, sand and gravel, pumice.
Trinity	729	512	Sand and gravel, stone, pumice.
Tulare	3,456	2,634	Sand and gravel, stone, natural gas, petroleum, clays, tungsten, gold.
Tuolumne	W	1,272	Lime, stone, sand and gravel, tungsten.
Ventura	89,318	87,531	Petroleum, natural gas, natural gas liquids, sand and gravel, stone, clays, pumice.
Yolo	5,255	6,430	Sand and gravel, natural gas, lime, stone.
Yuba	890	W	Sand and gravel, stone, clays.
Undistributed[1]	105,335	91,053	
Total[2]	1,920,648	1,851,365	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes federal offshore petroleum and natural gas, gem stones, natural carbon dioxide (1972), sand and gravel, stone (1972), and tungsten that cannot be assigned to specific counties, and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of California business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ....thousands..	8,606.2	8,830.4	+2.6
Unemployment ....do....	599.0	516.0	−13.9
Employment:			
Mining ....do....	30.4	29.4	−3.3
Contract construction ....do....	291.3	311.4	+6.9
Manufacturing ....do....	1,472.3	1,530.9	+4.0
Government ....do....	1,447.6	1,495.1	+3.3
Wholesale and retail trade ....do....	1,549.3	1,627.7	+5.1
Services ....do....	1,278.2	1,358.5	+6.3
Transportation and public utilities ....do....	453.4	457.0	+.8
Finance, insurance, and real estate ....do....	395.7	419.2	+5.9
Personal income:			
Total ....millions..	$94,118	$102,374	+8.8
Per capita	$4,640	$5,002	+7.8
Construction activity:			
Total private nonresidential construction..millions..	$2,419.3	$2,347.3	−3.0
Number of new housing units authorized	256,803	280,221	+9.1
Portland cement shipments to and within California thousand short tons..	8,530	8,491	−.5
Farm marketing receipts ....millions..	$5,117.5	$5,596.5	+9.4
Mineral production value ....do....	[r] $1,920.7	$1,851.4	−3.6
Exports through California ports ....do....	$3,690.1	$4,086.6	+10.7
Imports through California ports ....do....	$4,884.4	$6,493.7	+32.9

[p] Preliminary. [r] Revised.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Highlights of U.S. Export and Import Trade; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	5	90	(1)	4	--	--	--	--
Metal	2,160	262	565	4,518	6	123	28.55	8,648
Nonmetal	2,748	281	773	6,214	--	243	39.10	2,383
Sand and gravel	6,546	287	1,550	12,431	4	300	24.45	2,826
Stone	4,333	297	1,287	10,373	7	170	17.06	4,676
Total [2]	15,792	264	4,176	33,541	17	836	25.43	4,100
1972:[3]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	1,595	218	347	2,788	2	46	17.22	4,839
Nonmetal	2,335	288	673	5,485	--	248	45.21	1,118
Sand and gravel	3,475	225	782	6,345	1	166	26.32	2,195
Stone	3,650	296	1,080	8,676	2	126	14.75	2,052
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Less than 500.

[2] Data may not add to totals shown because of independent rounding.

[3] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

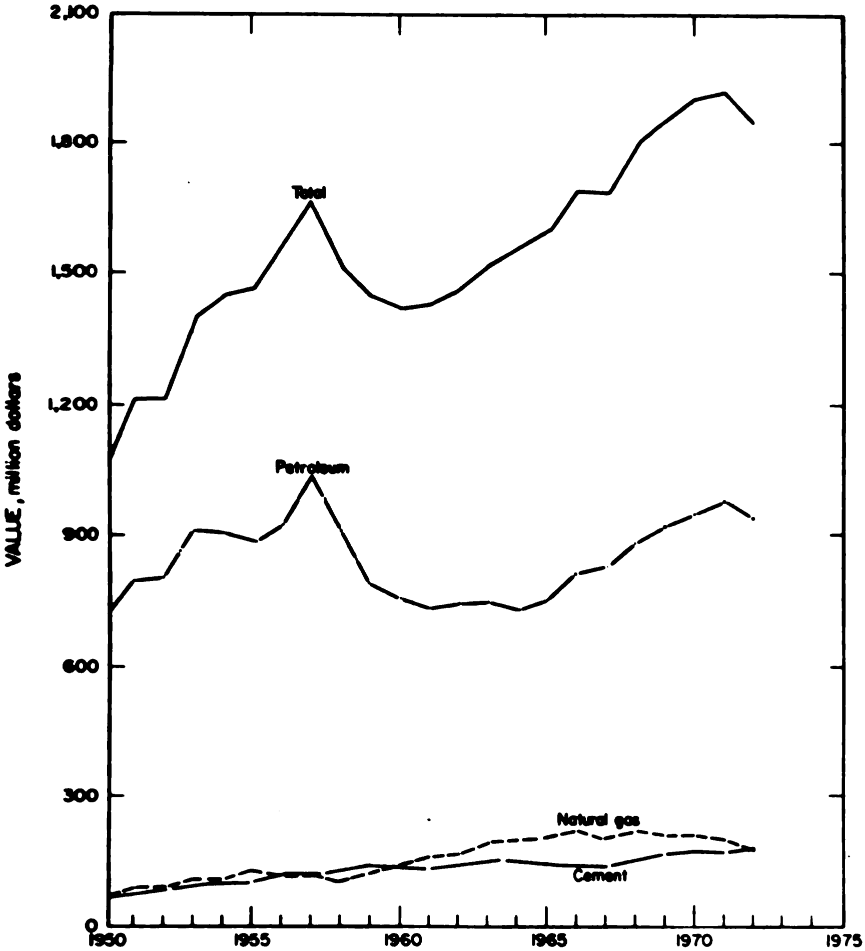

Figure 1.—Value of petroleum, natural gas, cement, and total value of mineral production in California.

metallurgy, including use and recycling of scrap mineral products; land use practices as they apply to mineral resource conservation; the study and development of methods for the control, disposal, reclamation, and utilization of mining and mineral processing waste products and reclamation of mined areas; and to enter into cooperative or contractual agreements for such investigations. Declared State policy regarding ultilization and conservation of mineral resources and provided for responsibility of State Geologist in implementing this policy.

Senate Bill (SB) 520—Increased membership of State Mining and Geology Board from 9 to 11 persons; designated Board as policy and appeals board considering earthquake hazards; defined responsibilities of State Geologist, cities, and counties on earthquake studies and land development; created Geologic Hazards Special Fund for California Division of Mines and Geology (CDMG) studies on earthquake hazard zones.

SB 1193—Extended (for 2 years) provisions requiring notification of Department of Fish and Game before approval is granted for proposed projects, including placer gold and sand and gravel, that would alter flow or bed of any body of water.

Senate Joint Resolution (SJR) 18—Memorialized President and Congress to support and enact legislation providing up to 50% funding for mine safety program in States retaining jurisdiction over mine safety.

Significant legislation enacted concerning the environment was as follows:

AB 64—Authorized counties to establish land fees, the revenue to be used for acquisition, operation, and maintenance of county waste disposal sites and for waste collection, processing, and reclamation.

SB 5—Created State Solid Waste Management Board within Resources Agency; required Board to adopt by January 1, 1975, State policy for solid waste management and State Solid Waste Resource Recovery Program for specified elements; created Advisory Council on these functions; declared intent that primary responsibility for solid waste management and planning shall rest with local Government; and required local and county planning programs.

Senate Concurrent Resolution (SCR) 9—Directed Resources Agency, upon enactment of solid waste legislation, to assign appropriate department or board to study on recycling solid wastes.

SCR 20—Requested Public Utilities Commission to review, modify, and establish rates for transport of materials for solid waste recovery.

SJR 9—Memoralized President and Congress to enact legislation for reasonable transport rates for purpose of solid waste recovery; memoralized Interstate Commerce Commission to review these rates.

AB 889—Enacted on September 21; known as the "Friends of Mammoth" decision; required filing of environmental impact statements for construction that may significantly affect the environment. In November, amendments to this bill were accepted by the Senate Governmental Organization Committee. After intensive negotiations between environmentalists on one hand and banking interests, the construction industry, and local governments on the other hand, a bill creating guidelines for regulating the "Friends of Mammoth" decision was passed by the Legislature and signed into law.

In January, the State Air Resources Board (ARB) adopted a plan that would bring the State into compliance with stringent Federal air quality standards. The plan recommended to the Legislature included the following: (1) Reduction of motor vehicle traffic by 20%in the San Francisco, Los Angeles, and San Diego areas, (2) use of natural gas or propane in cars in those areas, (3) installation of fuel evaporation controls on 1966–69 model cars, (4) extensive land-use planning and guidelines, (5) establishment of a Department of Transportation within the State, (6) use of low-lead gasoline, and (7) mandatory periodic vehicle inspections. The plan was considered unrealistic by both ARB and the Environmental Protection Agency (EPA). ARB unanimously passed a resolution requiring that automobiles manufactured prior to 1965 (an estimated 4.6 million in the State) be equipped with new smog-control devices before they can be sold in the three coastal metropolitan areas. Deadlines were established for each area.

The Bay Area Air Pollution Control District completed a new building and land-use permit system covering all potential sources of air contaminants in the nine-county Bay Area. This agency also adopted new rules requiring immediate reports on breakdown of pollution-control equipment and other company machinery and on corrective action planned.

The Office of Planning and Research (created pursuant to AB 2070, California Statutes of 1970) prepared and submitted to the Governor the First Environmental Goals and Policy Report, published on March 1, 1972. This report provided environmental goals and policies in planning future growth and considered the role of government at all levels in dealing with environmental concerns. It recommended establishment of an Environmental Resource Protection Plan, concerning the State's land and water resources.

The State Environmental Quality Study Council published a report, Environmental Quality in California, A Strategy for Action. The report covered Council activities during the preceding year, recommended legislative action, and considered a comprehensive strategy concerning land use, population growth, transportation, and energy use.

Proposition 9, the Clean Environment Act Initiative, was defeated in the June 6 ballot. This measure, sponsored by the People's Lobby, Inc., called for strict controls on lead and sulfur in motor fuels, oil and gas development, nuclear powerplants, pesticides, and variance procedures, and for strict penalties for violators.

California voters passed two initiatives (Propositions 3 and 20), both of which were of concern to the mineral industry, in the election of November 7. Proposition 3 authorized the Legislature to provide for issuance of revenue bonds to finance development, lease, or sale of pollution control facilities. Proposition 20, the Coastal Zone Conservation Act, approved a $5 million State appropriation for 1973–76 for the Coastal Zone Conservation Commission and six regional commissions, which have authority concerning development in coastal zones (1,000 yards inland to 3 miles offshore). The entire State coastal area would be covered except for the San Francisco Bay Area, which would remain under the jurisdiction of the Bay Area Conservation and Development Commission. Virtually all proposed development in the defined coastal zone would require a permit.

The California Comprehensive Ocean Plan (COAP), in preparation for 5 years, was released in June by the California Department of Navigation and Ocean Development. This plan was intended as the basis for State policy in the management of the State's coastal zone. It contained an inventory of coastal resources, discussed issues, and proposed guidelines for an equitable balance between conservation and development. Minerals and oil and gas resources in the coastal zone were discussed in an appendix to the report.

In July, the California Water Resources Control Board adopted new regulations governing discharge of wastes in the Pacific Ocean. Precise numerical limits were set on biological, chemical, and heavy-metal components of effluents. Discharge of radiological, chemical, or biological warfare agents or high-level radioactive wastes was prohibited. Industry estimated that these regulations could require $100 million in new capital expenditures.

In October, the State Assembly's Committee on Planning and Land Use released a study entitled "California's Electricity Quandary," prepared by a Rand Corp. research team. Forecasts indicated a projected need for 130 new powerplants, mainly nuclear, in the State by the year 2000. Alternatives were suggested that would reduce demand for energy. The report recommended establishment of an agency to coordinate energy conservation policies and oversee powerplant development according to acceptable land-use policies.

The Joint Committee on Atomic Development and Space of the California Legislature recommended creation of a special State Board to rule on siting of nuclear and other thermal powerplants. The committee also recommended formation of a Committee on Energy to review fuel and energy policies unencumbered by outside energy interests.

The Bay Area Regional Water Quality Control Board adopted new company-by-company regulations controlling waste discharges by oil refineries and chemical plants into San Francisco Bay and the ocean. Stringent limits were established on quantities of chemicals, oil, and grease and on maximum permissible temperatures of effluents dumped in the bay. The regulations would become effective over a period of several years. In November, the Board ruled that dumping of polluted dredging spoils would be permitted for cases of economic hardship. A 5-acre bay disposal area was designated.

The California Division of Mines and Geology (CDMG) was conducting a Statewide reconnaissance study of mines and potential mine pollution problems for the California Water Resources Control Board as a part of the River Basin Planning Study.

In February, the U.S. Forest Service sent two new wilderness proposals for California forest lands to Congress. These were the fifth and sixth studies completed from an original eight primitive areas in the State. The new areas were in the Stanislaus and Cleveland National Forests.

Early in the year, intial phases of the giant California Water Project were virtually complete. The budget was increased for new water sources, and research on desalination, weather modification, and waste-water reclamation. Other increases were proposed for prevention of water pollution and preparation of environmental impact statements.

A Federal Power Commission (FPC) examiner recommended that the FPC license the $1.5 billion California Aqueduct Project, a hydroelectric development project involving an area 475 miles long and expected to supply water for 12 million people in Southern California.

Geothermal Resources.—Exploration and development activity more than doubled compared with 1971. Eleven exploration wells (seven in Imperial County, two in Lake County, one in Mendocino County, and one in Modoc County) were started, and six wells had been completed at yearend. Development drilling, within established geothermal fields, totaled 20 new wells, 13 of which were producing steam and 7 were in progress at yearend.[3]

At The Geysers geothermal field, Sonoma and Lake Counties, there were 22 notices of intent to drill, and 15 wells were completed, of which 12 were successful. Union Oil Co. of California, operator of a joint venture with Magma Power Co. and Thermal Power Co., drilled nine productive wells. The field limits were extended as a result of the Union Oil Co. drilling. Construction continued on Pacific Gas & Electric Co. (PG&E) powerplants Nos. 5 and 6. Combined field capacity at yearend was 302,500 kilowatts. PG&E planned 673,000 kilowatts of geothermal power, 22% of its total power output, by 1977.

In Lake County, Getty Oil Co. assumed control of the Geothermal Resources, Inc. (GRI), Eureka Magma 1 well. The Lake County Planning Commission granted permits to deepen this well and drill two additional wells. Getty drilled to 7,822 feet and abandoned the well. Later in the year, Pacific Energy Corp. acquired control and planned to extend drilling to 10,000 feet.

At the Salton Sea project, near the southern end of the Salton Sea, Imperial County, a joint venture of the Magma Power Co. and San Diego Gas and Electric Co. drilled five wells (two production, two injection, and one observation). The companies planned an 8,000-kilowatt prototype powerplant, using the Magmamax process developed by Magma Energy, Inc., Los Angeles. At the Magmamax No. 1 well, the geothermal brine entered a separator where a portion of the fluid was flashed to steam and the remainder was used for reinjection. Data were obtained on flow rates, temperatures, and corrosion of various metals.

The Southern Pacific Land Co. acquired a 1,300-acre lease, also near the southern end of the Salton Sea, from the Imperial Irrigation District. Southern Pacific was seeking sources of power for rail-line electrification. Southern Pacific, in conjunction with Phillips Petroleum Co. and Mono Power Co. (subsidiary of Southern California Edison Co.), announced plans for geothermal research and development in the Buttes field, Imperial Valley, Imperial County. The tract comprised 30,000 acres on the southeastern edge of the Salton Sea, near the town of Niland.[4]

Elsewhere in Imperial County, outside the Salton Sea geothermal field, seven wells were drilled (five completed, two abandoned) during the year. Two wells were drilled on a heat anomaly in the East Mesa area; the first, for Magma Energy, Inc., was abandoned at 6,070 feet, and the second, for the Federal Bureau of Reclamation and Office of Saline Water (OSW), was drilled to 8,030 feet and tested at a maximum temperature of 365° F. This was part of the first phase of a feasibility project for brine desalination. OSW planned the installation of a pilot plant for desalination research.

In August, the State Lands Commission granted a 3-year exploration permit in the Imperial Wildlife Area to Atlantic Oil Co.

Two legislative bills concerning geothermal development were in committee at yearend. AB 890 would require the State Oil and Gas Supervisor to oversee drilling, operation, maintenance, and abandonment of geothermal wells in connection with land subsidence, caused by continued withdrawal of geothermal water. SB 113, scheduled for hearing in the Government Organization Committee, would authorize the Geothermal Resource Board, in conjunction with the U.S. Department of the Interior, to design a pilot plant to determine the most efficient and economic method for production of power, mineral byproducts, and demineralized water from geothermal resources.

In March, the following changes in the Public Resources Code, relative to geothermal resources, became effective: Geothermal districts were modified for greater efficiency in regulatory operations; California Division of Oil and Gas (CDOG) approval was required before drilling; filing of data for exploration programs and other records with the CDOG was required; and the terms of indemnity bonds were extended.

In June, the California Supreme Court denied a petition by 11 cities acting as the Northern California Power Agency, claiming antitrust violation, to set aside an order of the California Public Utilities Commission authorizing PG&E construction of four power stations, totaling 220,000 kilowatts, in The Geysers field. The ruling assured Magma Power Co., Thermal Power Co., and Union Oil Co. of California, operators of the field, of a market for the steam produced.

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[3] Resources Agency of California, Department of Conservation, Division of Oil and Gas. Oil, Gas, and Geothermal Production Statistics, 1972. Fifty-eighth Annual Report of the State Oil and Gas Supervisor. V. 59, No. 2, Sacramento, Calif., 1972, pp. 17–20.

[4] Engineering and Mining Journal. California Geothermal Fields To Be Developed by Three Companies. V. 173, No. 12, December 1972, p. 34.

The Geothermal Unit, CDOG, acquired, new personnel for its program on geology, well operation, chemical and corrosion studies, regulation, and delineation of geothermal resource areas. A study was underway in conjunction with Federal, State, and county agencies on possible subsidence problems in the valley comprising The Geysers field, where natural reservoir pressure was lowered with continued production of fluids. A survey indicated a subsidence of up to 6 inches in elevation in some surface areas since production operations started.

In February, the First National Conference of the Geothermal Resources Council was held at El Centro, Calif. The agenda included the following: U.S. and worldwide geothermal exploration and development, the Federal leasing program, operating regulations, U.S. Geological Survey work on geothermal resources, and powerplant operations.

The Pacific Coast Land Service prepared a set of maps showing geothermal areas in Imperial Valley.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Natural Gas.—Net and marketed production, exploration, and reserves continued a downward trend. Marketed output was down about 20%, although demand within the State was expanding at a steady rate. Imports from out-of-State averaged 4.6 billion cubic feet per day, according to the California Conservation Committee of Oil Producers (CCCOP). Discoveries included two extensions to known gas deposits, one deeper deposit, three new small gasfields, and three new deposits in known gasfields. For the first time in the State, the number of wildcat wells drilled primarily for gas exceeded that for oil.

The CCCOP reported a 16% decrease in gross production and a 19% decrease in net output, compared with 1971 data. The Rio Vista field, the largest in the State, produced a net of 71,399 million cubic feet, or 195 million cubic feet per day, a slight increase over the 1971 rate.

In the Federal outer continental shelf (OCS), output dropped 30%. There were no new gas operations. The sources of gas were the Carpinteria field of Phillips Petroleum Co. and the Dos Cuadras field of Sun Oil Co. and Union Oil Co. of California.

The California Public Utilities Commission filed an appeal with the Federal Power Commission (FPC), objecting to a Federal order restricting imports of natural gas. FPC contended that existing gas storage systems, not developed in other Western States, provided available supply during peak use period. In October, an FPC order reduced the State's allotment of marketed gas from El Paso Natural Gas Co. by 15%.

Pacific Lighting Corp., distributor of natural gas in the Los Angeles basin through its subsidiary, Southern California Gas Co., announced plans for alleviating a pending shortage by importing liquefied natural gas from Cook Inlet, Alaska, and possibly also from Australia and Indonesia by 1976.

Smog Abatement Systems, Inc., opened Southern California's first center for conversion of motor vehicles to compressed natural gas (CNG), in Los Angeles. Estimated conversion cost was $400–$500 per vehicle. Tests by the ARB, conducted over a 1-year period, indicated that CNG-fueled vehicles would meet the State's 1975 emission standards. In August, a public hearing on the feasibility of this conversion was held in Los Angeles by the ARB. Information was sought on availability of gaseous fuels (natural gas and liquefied petroleum gas), conversion equipment, trained labor for making the conversions, and the marketing and performance of gaseous fuels. The general conclusion was that the available supply of natural gas was insufficient for the proposed number of conversions.

Natural Gas Liquids.—Total output declined nearly 20% compared with that of 1971. The CDOG reported output of field condensate at 337,292 barrels from State-controlled properties, including 196,983 barrels onshore and 140,309 barrels from offshore State leases.

Petroleum.—*Production.*—Overall output of crude oil, including that from land and marine (State and Federal) wells, decreased

3.2% compared with the 1971 rate. Onshore and Federal offshore output were in a continuing decline, but that from State offshore areas showed a slight increase. The loss of production was attributed to a normal decline in yield from wells and to the lack of new fields that would augment output significantly. Other detrimental factors were increasing costs and environmental considerations, particularly in connection with State and Federal offshore operations.

The Wilmington field was the leading producer, with output of 70,134,000 barrels (nearly 22% of total output from State-held properties). Production in other major producing fields was as follows, in thousand barrels; Midway-Sunset 34,579; Kern River, 27,154; and Huntington Beach, 21,640.[5]

In State offshore areas, the CDOG reported a slight increase in production, although the moratorium on drilling, established by the State Lands Commission in 1969, remained in effect. Output from State offshore leases was 22% of the total from all State properties in 1972. Notices were filed for 30 new wells, 44 redrills, 109 reworks, and 72 abandonments.

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[5] Page 63 of work cited in footnote 3.

Table 5.—California: Oil and gas salient statistics

	1971	1972
Production:		
Crude oil:[1]		
Quantity ---- thousand 42-gallon barrels--	358,484	347,022
Value ---- thousands--	$975,076	$940,430
Daily rate ---- thousand 42-gallon barrels--	982	951
Price, average ---- per barrel--	$2.72	$2.71
Natural gas, marketed:		
Quantity, net ---- million cubic feet--	612,629	487,278
Value ---- thousands--	$199,717	$179,318
Price at wellhead, average ---- per thousand cubic feet--	$0.326	$0.368
Natural gas liquids:		
Quantity ---- thousand 42-gallon barrels--	17,800	14,315
Value ---- thousands--	$52,027	$43,626
Price, average ---- per barrel--	$2.92	$3.05
Operating companies (yearend) ----	806	802
Producing wells:		
Oilfield (average) ----	40,406	39,586
Gasfield (maximum) ----	1,068	1,086
Exploration and development: Well completions:		
Exploration:		
Oil ----	21	17
Gas ----	r 7	9
Dry ----	r 192	160
Development:[2]		
Oil ----	1,438	1,028
Gas ----	r 53	53
Dry (abandoned) ----	r 94	128
Total ----	1,805	1,395
Footage ---- thousands--	4,997	4,347
Refineries:		
Number in operation (yearend) ----	35	37
Crude oil throughput capacity (operating) thousand 42-gallon barrels per day--	1,733	1,759
Gasoline output capacity (operating) thousand 42-gallon barrels per day--	1,018	1,019

r Revised.

[1] Includes field condensate but not plant condensate; also includes output from offshore State and Federal leases.

[2] Includes service wells.

Sources: California Department of Conservation, Division of Oil and Gas; Conservation Committee of California Oil Producers; American Petroleum Institute; and U.S. Bureau of Mines.

Table 6.—California: Production of crude petroleum and natural gas in 1972, by county[1]

County	Number of producing wells		Production		
			Petroleum	Natural gas (net)	
	Oil (average)	Dry gas (maximum)	(thousand barrels)	Oil zones (million cubic feet)	Dry gas zones (million cubic feet)
Alameda	7	--	121	--	--
Butte	--	22	--	--	4,136
Colusa	--	97	--	--	9,775
Contra Costa	43	57	[2] 353	2,487	10,739
Fresno	2,598	2	13,578	11,238	469
Glenn	--	116	--	--	14,068
Humboldt	--	26	--	--	3,669
Kern	21,442	60	113,134	80,648	2,411
Kings	150	9	501	11,144	625
Los Angeles	6,455	3	104,137	66,188	455
Madera	--	15	--	--	3,129
Monterey	953	--	10,952	960	--
Orange	3,348	--	37,372	11,074	--
Riverside	15	5	116	61	325
Sacramento	--	103	[2] 25	--	39,947
San Benito	27	--	65	51	--
San Bernardino	40	--	321	161	--
San Joaquin	--	108	--	--	55,857
San Luis Obispo	200	--	1,845	1,339	--
San Mateo	10	--	17	1	--
Santa Barbara	1,603	26	[2] 18,338	25,739	26,760
Solano	--	183	[2] 151	--	81,594
Sonoma	--	4	--	--	4
Sutter	--	144	--	--	34,857
Tehama	--	42	--	--	4,788
Tulare	24	19	41	--	1,464
Ventura	2,671	4	23,722	27,705	966
Yolo	--	41	--	--	8,011
Total	39,586	1,086	[2] 324,789	238,796	304,049

[1] Includes State offshore but not Federal offshore production.
[2] Includes field condensate from dry gas zones.
Source: California Department of Conservation, Division of Oil and Gas.

In the OCS, beyond the State 3-mile limit, output declined sharply. No permits were granted for new platforms. Output was 61,800 barrels per day, compared with 85,200 barrels per day in 1971.

Production was sustained by continuing secondary recovery projects. The CCCOP reported 17 gas injection projects, largely in the San Joaquin Valley fields, 185 waterflood projects, and 28 steam injection projects, at yearend. In December, total waterflooding was at a rate of 3 million barrels of water per day in the Los Angeles Basin, San Joaquin Valley, and Coastal fields. The Wilmington waterflood project was the largest of its type in the world, and that of the Huntington Beach offshore field was under expansion.[6]

Exploration and Development.—The drilling rate declined during 1972. Exploration was at the lowest level in 30 years; only 186 exploration wells, 160 of which were dry, were completed. A number of discoveries were reported, but all were of minor significance. They included 12 extensions to known fields, one deeper pool, two new fields, and four new pools.[7]

Texaco, Inc., planned a deep well, possibly to 25,000 feet, at a site 20 miles south of Bakersfield, Kern County. The deepest well drilled in the State was 21,482 feet.[8]

In offshore State-controlled areas, the moratorium on drilling, existing since 1969, remained in effect, although there were indications that regulations may be eased by the State Lands Commission. In Federal waters, regulations continued to limit the number of drilling areas. No new exploration was permitted, but ongoing development projects were completed. In September, Exxon Oil Corp. completed a 35-well development program and confirmed dis-

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[6] Conservation Committee of California Oil Producers. Annual Review of California Oil and Gas Production, 1972. Los Angeles, Calif., June 1973, pp. 26 30.

[7] Higgins, J. W. Developments in West Coast Area in 1972. AAPG Bull., v. 57, No. 8, August 1973, pp. 1437-1447.

[8] Oil and Gas Journal. California's Current Depth Record May Be Broken in 1973. V. 70, No. 51, Dec. 18, 1972, p. 112.

Table 7.—California: Offshore oil and gas production in 1972, by field[1]

Field or area	Number of producing wells	Production: Oil (thousand barrels)	Production: Gas (million cubic feet)
State:			
Alegria	1	51	140
Belmont	77	2,149	514
Caliente: Gas zone	2	--	1,199
Carpinteria	57	1,821	1,958
Coal Oil Point	3	41	80
Conception	18	283	201
Cuarta:			
Oil zone	1	--	4
Gas zone	2	--	45
Elwood	12	64	623
Elwood, South	10	761	544
Gaviota: Gas zone	2	--	979
Huntington Beach	349	16,693	2,586
Molino: Gas zone	7	--	10,129
Montalvo, West	6	102	--
Newport, West	15	131	39
Point Conception	3	153	61
Rincon	87	662	380
Summerland	21	355	1,965
Torrance	16	171	128
Venice Beach	4	182	73
Wilmington	1,008	49,409	13,097
Total	1,701	73,028	34,745
Federal:			
Carpinteria	**51**	**2,562**	**1,601**
Dos Cuadras	**124**	**20,001**	**10,946**
Total	**175**	**22,563**	**12,547**
Grand total	**1,876**	**95,591**	**47,292**

[1] Includes production from offshore portions of onshore fields.

Source: California Department of Conservation, Division of Oil and Gas.

Table 8.—California: Oil and gas well drilling completions in 1972, by county

County	Development wells[1] Oil	Development wells[1] Gas	Development wells[1] Dry	Exploratory wells Oil	Exploratory wells Gas	Exploratory wells Dry	Total Number of wells	Total Footage
Alameda	--	--	1	--	--	--	1	3,416
Butte	--	--	--	--	--	1	1	3,000
Colusa	--	6	2	--	--	3	11	71,403
Contra Costa	1	1	3	--	1	6	12	71,661
Fresno	42	3	6	1	--	4	56	186,047
Glenn	--	--	5	--	1	7	13	67,659
Humboldt	--	--	--	--	--	2	2	15,122
Kern	636	5	47	3	--	30	721	1,407,251
Kings	1	1	2	--	--	3	7	51,934
Los Angeles:								
Onshore	61	1	8	--	--	11	81	367,584
Offshore[2]	27	--	1	--	--	--	28	97,965
Merced	--	--	--	--	--	2	2	11,286
Monterey	55	--	6	--	--	5	66	165,614
Orange:								
Onshore	78	--	5	--	--	2	85	183,708
Offshore[2]	29	--	2	--	--	1	32	115,994
Sacramento	--	1	--	--	--	1	2	17,625
San Benito	--	--	--	--	--	1	1	1,400
San Bernardino	1	--	--	--	--	4	5	15,778
San Joaquin	--	2	4	--	1	9	16	141,782
San Luis Obispo	11	--	--	1	--	4	16	50,780
San Mateo	1	--	--	--	--	--	1	2,768
Santa Barbara	44	--	2	9	--	3	58	247,251
Santa Cruz	--	--	--	--	--	1	1	5,767
Solano	--	16	9	--	2	7	34	229,829
Stanislaus	--	--	--	--	--	2	2	14,998
Sutter	--	4	2	--	--	6	12	62,080
Tehama	--	--	1	--	1	2	4	18,124
Tulare	1	2	1	--	--	3	7	13,925
Ventura	39	1	2	3	--	15	60	400,141
Yolo	--	10	19	--	3	22	54	273,266
Other: Federal offshore	1	--	--	--	--	3	4	31,790
Total	1,028	53	128	17	9	160	1,395	4,346,948

[1] As defined by American Petroleum Institute.
[2] State leases.

Source: American Petroleum Institute.

coveries on six tracts in the Santa Ynez Unit, which was held jointly with Shell Oil Co. and Standard Oil Co. of California. In April, Exxon submitted a proposed development program to the U.S. Geological Survey in Los Angeles and received preliminary approval.[9]

Refineries.—In its 1972 annual report, Standard Oil Co. of California stated that throughput at the El Segundo refinery, Los Angeles County, reached a record level. Demand for foreign crude oil was increased at this refinery and also at the Richmond refinery, Contra Costa County. At El Segundo, new desulfurization facilities went on-stream, and increased capacity was planned for low-sulfur fuel oil.

Legislation and Programs.—Legislation enacted during the year, concerning the petroleum industry, included the following:

SB 1022—Redefined term "well;" required chief deputy and district deputies, CDOG, to be State-registered engineers or geologists; revised provisions pertaining to filing bonds for drilling operations; prohibited drilling starts until notice of intent approved by supervisor or district deputy; revised provisions pertaining to well abandonment; required monthly statement on disposition of water from well.

SB 1326—Known as Compulsory Unitization Bill; passed legislature in late 1971; effective March 4, 1972; incorporated in Public Resources Code; provided for mandatory unitization within incorporated city limits, when 75% of working interests reach unitization agreement; required approval of State Oil and Gas Supervisor; applied only to areas with 20-year production history.

AJR 6—Memorialized President and the Department of the Interior to withhold production in Federal waters until absolute safeguards for production and cleanup have been developed and public hearings conducted; and to deny drilling permits until fail-safe production and cleanup systems are developed and deployed.

AB 2341—Authorized Governor to adopt State oil spill contingency plan; provided for use of volunteer workers and their compensation; permitted recovery of expenses from State Water Pollution Cleanup and Abatement Account of State Water Quality Control Fund; made party responsible for spill liable for cleanup costs.

In February, the State Water Resources Control Board licensed a new oil-spill control agent for use in State waters. The product, known as imbiber beads and developed by The Dow Chemical Co., would flocculate oil into beads that could be readily removed from the water.

Exxon Corp. developed a "bottom-tension" oil-spill containment boom, capable of working in 20-foot waves, a 2-knot current, or 60-knot winds. This boom became part of standby equipment of Clean Seas, Inc., for emergency use in the Santa Barbara channel. It may be launched from a supply vessel or deployed from shore.

An Orange County law, probably the first in the United States that would phase out lead additives in gasoline, was declared invalid by the State Superior Court.

Oil Operators, Inc., an association of 37 companies, financed a reclamation project for oil sumps in the Long Beach area. The project involved continued soil discing and spreading; no soil was added or removed.[10]

An EPA regional plan would reduce gasoline consumption 86% during the

Table 9.—California: Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Proved reserves Dec. 31, 1971	Changes in proved reserves due to extensions and discoveries in 1972	Proved reserves Dec. 31, 1972 (production deducted)	Changes from 1971 (percent)
Crude oil ....thousand barrels..	3,705,750	194,797	3,553,735	−4.1
Natural gas liquids ....do....	151,091	(10,056)	126,726	−16.1
Natural gas ....million cubic feet..	5,729,199	113,329	5,328,862	−7.0

Sources: American Petroleum Institute and American Gas Association.

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[9] Oil and Gas Journal. Santa Ynez Plan Passes First-Round Test. V. 70, No. 17, Apr. 24, 1972, p. 44.

[10] Oil and Gas Journal. California Project Turning Sump to Soil. V. 70, No. 37, Sept. 11, 1972, p. 58.

"smog season" in a six-county area, including Los Angeles County, by 1975–76. A preliminary draft, incorporating a number of recommendations for combatting air pollution, was submitted in December.

The Los Angeles Harbor Commission urged development of the Port of Los Angeles for handling supertankers of 250,000-ton capacity. Existing facilities at the Outer Harbor terminal were capable of berthing tankers of 120,000 tons.

NONMETALS

Asbestos.—Production and shipments were slightly higher in 1972, mainly due to increased output at the open pit mine and mill of Pacific Asbestos Corp., the leading producer, near Copperopolis, Calaveras County. Computer planning, based on data from an extensive drilling program, aided in pit development and mining. Baghouses, a vacuum system, and a monitoring system aided in dust abatement at the mill.

Barite.—Industrial Minerals Co. (formerly Yuba Barite and Milling Co.) reported output of 4,200 tons of crude barite, more than double the 1971 rate, at the Castella mine, Shasta County.

A new barite circuit was completed in June at the Molybdenum Corp. of America (Molycorp) rare-earths operation at Mountain Pass, San Bernardino County. Heads contained 20% $BaSO_4$ at the bastnaesite concentrating plant.

Boron.—Production increased slightly, compared with that of 1971. U.S. Borax & Chemical Corp. operated at full capacity because of rising world demand for borax and other boron chemicals. The company's large open pit at Boron, Kern County, reached a depth of 480 feet. Work continued on reducing dust discharges from the mine and chemical plant.

At Searles Lake, San Bernardino County, Kerr-McGee Chemical Corp. planned a modernization and expansion program to increase output and meet environmental requirements. At the southern end of the lake, Hooker Chemical Corp., a subsidiary of Occidental Petroleum Corp., was delayed in planned production operations because of excessive subsurface brine drawdown in the lake bed. Seven large solar ponds were completed and partially filled with brine. Pumping started in January, but was reduced and then terminated while the U.S. Geological Survey studied brine migration and drawdown.

Tenneco, Inc., mined colemanite (hydrous calcium borate) from its Pit No. 1 in Death Valley National Monument, near the town of Ryan, Inyo County. A minus-8-inch ore was trucked 31 miles to a new calcining plant in Nevada.

Calcium Chloride.—Production of a liquid calcium-magnesium chloride, containing 40% $CaCl_2$, from brines at Bristol Lake, San Bernardino County, declined 32% compared with that of 1971, owing to lower general salt sales. Leslie Salt Co., one of two operating companies at Bristol Lake, planned a program for increased production.

Cement.—Production increased 3% over the 1971 rate, and shipments were slightly reduced, although value of shipments was substantially higher.

Ideal Cement Co., a division of Ideal Basic Industries, Inc., made plans to replace the 60-year-old plant at San Juan Bautista, San Benito County, with a new pollution-free, $37 million, 564,000-ton-per-year plant in 1975. In the meantime, the old plant was operated under variances granted by county environmental authorities.

According to the annual report of Kaiser Cement & Gypsum Corp., a $2.5 million pollution control program, started in 1971, was completed at the Permanente plant,

Table 10.—California: Principal commercial nonmetal grinding plants in 1972

Company	County	City or town
American Mineral Co	Los Angeles	Los Angeles.
Calcite Corp	Kern	Rosamond.
California Zonolite Co., a division of W. R. Grace & Co.	Alameda	Newark.
Do	Los Angeles	Los Angeles.
Minerals, Pigments & Metals Division of Pfizer & Co., Inc	San Bernardino	Victorville.
Industrial Minerals and Chemical Co	Sacramento	Florin.
Standard Industrial Minerals, Inc	Inyo	Bishop.
Western Talc Co	San Bernardino	Dunn.
Wilbur Ellis Co	Fresno	Fresno.

Santa Clara County, in compliance with regulations of the Bay Area Air Pollution Control District. Plans were made for a land restoration program at the Permanente quarry, where extensive grading, planting, and irrigation would be carried out in mined-out terrain. An air pollution control program was also underway at Kaiser's plant in Lucerne Valley, San Bernardino County, and was scheduled for completion in 1973 under a timetable approved by the County Air Pollution Control District.

Monolith Portland Cement Co. completed the second phase of a modernization program at Monolith, Kern County, to meet air pollution control requirements. A new crushing system, quarry-to-mill conveyor, and dust-control equipment were installed, and new kilns were planned. The first kiln (15 feet in diameter and 520 feet long), with annual capacity of 470,000 tons, was scheduled for operation in 1974, and a second kiln in 1976. Five old kilns were to be dismantled.

Clays and Shale.—Production of clays (common, ball, bentonite, fire, fuller's earth, kaolin) and shale was reported from 47 properties. Output was slightly lower than in 1971, although total value was higher because of increased prices. Common clay accounted for 94% of total industrial uses during 1972.

Interpace Corp. continued mining operations with hydraulic monitors and a clay-sand slurry at the Ione pit, Amador County. The new mining procedure involved development of a curved pit around a dragline and a surge pile with hydraulic monitor feed to slurry pumps. The clay fraction was separated in thickeners, dewatered by vacuum filters, compacted and pelletized in extrusion machines, and calcined in horizontal rotary kilns.

Diatomite.—California again was the leading State in production of diatomite, accounting for approximately two-thirds of total U.S. output. Production increased 9% in the State, compared with 1971 output. Johns-Manville Products Corp., Celite Div., at Lompoc, Santa Barbara County, was the leading producer. At its open pit mine, the company planned to introduce the use of large-wheel loaders and larger capacity equipment.

Feldspar.—Output from flotation concentrate and in feldspar-silica mixtures was nearly 20% lower compared with that of 1971, owing to reduced activities necessitated by environmental regulations at some of the feldspar-glass sand operations. Principal producers were Wedron Silica Co. and Owens-Illinois, Inc., both at Pacific Grove, Monterey County. In addition, Crystal Silica Co. recovered a flotation concentrate at its Crystal operation, San Diego County, and Santa Cruz Aggregates Co. produced a feldspar-silica mixture near Santa Cruz, Santa Cruz County. Wedron Silica Co. also processed feldspar at a grinding plant, near Pebble Beach, Monterey County, for use in pottery.

Graphite (Manufactured).—Great Lakes Carbon Corp. made graphite furnace products (anodes, electrodes, crucibles, cloths, fibers, etc.) and powder and scrap (carbon raiser in steelmaking) from petroleum coke at Antelope Valley, Kern County. Minor production was reported by Hitco Co. and Polycarbon, Inc. Total output was nearly 20% below that of 1971.

Gypsum.—Output of crude gypsum was 13% higher than that of 1971. United States Gypsum Co. at Plaster City, Imperial County, and N. M. Holloway, Inc., at Lost Hills, Kern County, again were the prinpal producers. About half of this crude gypsum was used as a cement retarder and in agriculture. In addition, 278,600 tons of byproduct gypsum was sold for agriculture use. The remainder was used in manufacturing wallboard.

United States Gypsum Co. (Alameda County), National Gypsum Co. (Contra Costa County), The Flintkote Co. (Imperial County), and California Gypsum Co. (Los Angeles County) produced calcined gypsum, output of which increased 31% over that of 1971.

Modernization at the wallboard plant of Kaiser Cement & Gypsum Corp., at Long Beach, Los Angeles County, was expected to be completed early in 1973. The grinding and calcining equipment was replaced, and pollution control was improved.

Lime.—Although production of quicklime and hydrated lime was 3.5% below that of 1971, value of output was higher because of increased prices. Ten companies produced lime at 15 plants. The leading producer was Kaiser Aluminum & Chemical Corp. at Natividad, Monterey County.

The lime was used for precipitating magnesia from sea water, sugar refining, soil stabilization, refractories, and miscellaneous minor applications. Total consumption was 794,200 tons.

Table 11.—California: Finished portland cement[1]

(Thousand short tons and thousand dollars)

District[2]	Active plants	Clinker capacity[3] Dec. 31	Production	Shipments from mills			Stocks at mills Dec. 31	Apparent consumption[4]
				Quantity	Value			
					Total	Average per ton		
1971:								
Northern California	6	3,218	2,893	3,109	60,874	19.58	296	3,207
Southern California	8	7,151	6,212	6,008	109,047	18.15	391	5,323
Total	14	10,369	9,105	9,117	169,921	18.64	687	8,530
1972:								
Northern California	5	3,248	2,783	2,855	57,320	20.08	267	3,026
Southern California	8	6,956	6,609	6,231	124,988	20.06	306	5,465
Total	13	10,204	9,392	9,086	182,308	20.06	573	8,491

[1] Includes white cement.

[2] Northern and southern California are divided by the northern boundaries of San Luis Obispo and Kern Counties and the western boundaries of Inyo and Mono Counties.

[3] Calculated on individual company data (365 days minus average days for maintenance times the reported 24-hour capacity).

[4] Includes receipts from other States; excludes imports from foreign countries.

Table 12.—California: Source and destination of shipments of portland cement
(Thousand short tons)

Destination	Northern California mills		Southern California mills		Total	
	1971	1972	1971	1972	1971	1972
Northern California	2,578	2,407	371	371	2,949	2,778
Southern California	50	18	5,269	5,408	5,319	5,426
Nevada	38	36	227	227	265	263
Oregon	W	W	W	W	(1)	(2)
Arizona	—	—	130	151	130	151
Other	[3] 443	[3] 394	[4] 11	[4] 74	454	468
Total	3,109	2,855	6,008	6,231	9,117	9,086
Building material dealers	179	181	537	520	716	701
Concrete product manufacturers	245	236	738	708	983	944
Ready-mix concrete companies	2,014	1,920	3,987	4,439	6,001	6,359
Highway contractors	338	204	497	340	835	544
Other contractors	157	175	215	155	372	330
Federal, State, and local government agencies	4	2	13	28	17	30
Miscellaneous customers, including use by cement companies	172	137	21	41	193	178
Total	3,109	2,855	6,008	6,231	9,117	9,086

W Withheld to avoid disclosing individual company confidential data; included with "Other."

[1] Included with "Other;" total 243,635 tons shipped from northern and southern California to Oregon.

[2] Included with "Other;" total 277,176 tons shipped from northern and southern California to Oregon.

[3] Includes Alaska, Colorado (1972), Hawaii (1971), Idaho (1972), Montana (1971), Oregon, Washington, foreign countries (1971), and U.S. Possessions.

[4] Includes Alaska, Colorado, Hawaii (1971), Iowa (1971), New Mexico (1972), Oregon, Texas, Utah, Washington, foreign countries, and U.S. Possessions.

Lithium Compounds.—Kerr-McGee Chemical Corp., only lithium producer in the State, produced lithium carbonate from lithium-sodium phosphate in brines at Searles Lake, San Bernardino County. Output was 19% below that of 1971.

Magnesium Compounds.—California ranked second as a producer of magnesium compounds (MgO equivalent). Output increased 15% compared with that of 1971. Kaiser Refractories, Moss Landing, Monterey County, the leading producer, increased output of MgOH, MgO, and caustic-calcined MgO. Kaiser installed high-energy, wet Venturi scrubbers, replacing precipitators at two of three kilns to remove dust from air discharge. The third kiln was to be similarly equipped in 1973. The company also made plans to terminate discharge of effluents into the harbor and extend an effluent pipeline to the outer bay.

Nitrogen.—Collier Carbon and Chemical Corp., Los Angeles, a wholly owned subsidiary of Union Oil Co. of California and the largest producer of nitrogen on the West Coast, increased efficiency at its ammonia plants with mechanical improvements and process changes. The plant at Brea, Orange County, was capable of production above designed capacity.

Perlite.—The production rate in 1972 was similar to that of 1971. American Perlite Co. was the sole producer of crude perlite, at its Fish Springs quarry, near Big Pine, Inyo County. Seven companies, five in Los Angeles County, continued to produce expanded perlite for use (in order of importance) as filter aid, concrete aggregate, plaster aggregate, horticultural aggregate, and in miscellaneous applications. Production of expanded perlite was 21,227 tons, compared with 23,512 tons in 1971.

Phosphate Rock.—In April, the Attorney General of California petitioned the Secretary of the Interior for USGS reexamination of the phosphate rock deposit of United State Gypsum Co. in Los Padres National Forest, Ventura County. This petition included the following: (1) the USGS implement the National Environmental Policy Act (NEPA) of 1969 in determining whether a valuable deposit has been discovered, (2) a cost-benefit analysis be made, and (3) a reevaluation of the previous determination regarding a valuable discovery, if studies indicate that costs exceed benefits or if the granting of a mining lease was in opposition with the purposes and goals of NEPA.

In July, environmental hearings were held in Ventura, Ventura County, on the environmental impact of mining this deposit and possible effects on the California condor.

California Assembly Joint Resolution (AJR) 34 memorialized the President and Congress to take all steps necessary to prevent open pit mining of this deposit.

Potassium Salts.—Production was nearly 7% lower (in terms of K_2O equivalent), compared with 1971 output, at the Searles Lake operation of Kerr-McGee Chemical Corp. in San Bernardino County, where KCl and K_2SO_4 were recovered from subsurface brines. A modernization and expansion program, designed to increase output and meet county environmental requirements, was planned by the company.

Construction was delayed at the new operation of Hooker Chemical Corp., a subsidiary of Occidental Petroleum Corp., located at the southern end of Searles Lake, pending USGS approval of a long-range program governing the rate of brine extraction.

Pumice.—Combined output of crude and prepared pumice, pumicite (volcanic ash) and scoria (volcanic cinder) advanced 4.6%, compared with 1971 output. There were 31 operators, 81 mines, and 14 preparation plants. The U.S. Forest Service was the principal producer and user for road construction in Lassen Forest, Lassen County, and Shasta-Trinity Forest, Shasta County. About 69% of total output was used in road building; the remainder was consumed in concrete aggregate, railroad ballast, abrasives, and a number of miscellaneous applications.

Salt.—Leslie Salt Co., with operations in Alameda, Napa, San Bernardino, and San Mateo Counties, again was the leading salt producer. Total State output was 14% lower than that of 1971, owing mainly to completion of a contract and reduced export demand for salt from the Leslie works. Construction continued on a pipeline to carry brine from Leslie's Newark No. 1 to the Newark No. 2 works, the largest in the San Francisco Bay Area. This would expand Newark No. 2 capacity from 550,000 tons to 614,000 tons per year. Another change made by Leslie Salt was a new line carrying the entire supply of partly concentrated brine to the Redwood City works, San Mateo County, from the Mount Eden and Newark No. 1 works.

Kaiser Engineers, a division of Kaiser Industries Corp., received a contract from the California Department of Water Resources for an engineering and economic feasibility study, preliminary design, and cost estimates for a proposed large-scale prototype seawater desalting plant at a coastal site in San Luis Obispo County. The project was funded by the State and the U.S. Department of the Interior, Office of Saline Water.

Conservationists filed a lawsuit to compel Leslie Salt Co. to remove dikes on and around Bair Island in San Francisco Bay. The salt evaporation ponds were not in use.

Sand and Gravel.—Output was slightly higher than that of 1971. Los Angeles County again led other counties as the principal producer. Production was wide-

Table 13.—California: Pumice[1] sold or used by producers in 1972, by county

County	Crude		Prepared		Total	
	Short tons	Value	Short tons	Value	Short tons	Value
Kern	--	--	W	W	W	W
Lake	--	--	W	W	W	W
Lassen	W	W	W	W	91,709	$98,080
Madera	--	--	W	W	W	W
Modoc	W	W	W	W	75,862	71,041
Mono	W	W	W	W	36,807	199,936
Nevada	8,371	$9,200	--	--	8,371	9,200
Plumas	W	W	W	W	W	W
San Bernardino	--	--	W	$207,146	W	207,146
Shasta	68,922	54,320	18,890	17,423	87,812	71,743
Siskiyou	W	W	W	W	97,961	163,407
Sutter	--	--	56,000	81,000	56,000	81,000
Tehama	W	W	W	W	W	W
Trinity	--	--	W	W	W	W
Ventura	--	--	W	W	W	W
Undistributed	227,265	245,472	351,093	892,532	276,019	605,540
Total	304,558	308,992	425,983	1,198,101	730,541	1,507,093

W Withheld to avoid disclosing company confidential data; included with "Undistributed."

[1] Includes pumicite and volcanic cinder.

spread throughout the State, each of the 58 counties recording activity.

In the San Gabriel Wash area, Los Angeles County, which supplied a large share of the sand and gravel needs in the Los Angeles metropolitan area, Livingston-Graham, Inc., mined alluvial material at a rate of 2,200 to 2,400 tons per hour at its pit near El Monte and produced 35 commercial products at its automated and modernized crushing-screening plant. The company considered the acquisition of a dragline for future use in mining below the water table and planned a conveyor system from pit to processing plant, replacing truck haulage. Operations were under a long-range rehabilitation plan, required by city zoning regulations. Owl Creek Products Co. had a plant, adjacent to the Livingston-Graham operation, with a large walking dragline for mining below the water table.

Sand was in short supply in the Los Angeles metropolitan area, mainly because large quantities were used in pumping a slurry for cement.

In July, Conrock Co. started production at its new open pit in the San Gabriel Wash, near Irwindale, and, in September, opened its new Reliance crushing-screening plant. An underground conveyor system carried material from the pit, under an intervening freeway, to the processing plant. Initial plant capacity was 1,200 tons per hour, but designed flexibility would permit easy expansion to peak loads of 2,400 tons per hour. The company made 12 commercial products at this plant, which operated on a fully computerized schedule. Blending and loading were automated from 25,000-ton storage bunkers to a four-truck loading platform and weighing scale. Dust control practices included an additive to water at the crushers and a plastic surfacing on haulage roads.

In July, the Flintkote Co. announced the acquisition of Associated Rock Products, which had four ready-mix concrete plants and extensive sand and gravel reserves in the Pomona Valley area of southern California.

Construction sands, specialty sands, and fill were dredged in offshore marine areas, particularly in the Bay Area, where, during the 1½-year period ended June 1972, an estimated 3 million cubic yards was recovered. The U.S. Army Corps of Engineers also used these offshore sands for beach restoration and improvement in the Santa Cruz area, Santa Cruz County, and proposed a similar project for the Newport Beach area, Orange County.

Owens-Illinois Inc. operated its new sand-processing plant near San Juan Capistrano, Orange County. A glass sand was produced from an Eocene sandstone (Santiago formation), which contained 50% quartz and 50% feldspar.

According to the annual report of Del Monte Properties Co., the new Wedron Silica Division's new silica sand plant at Byron, 15 miles north of Stockton in San Jaoquin County, was operational at yearend. The company's sand plant at Pacific Grove, Monterey County, faced closure because of orders from the Central Coastal Regional Water Quality Control Board to reduce ocean discharge of silt and other inert solids from 240 tons per day to a maximum of 208 tons per day by September 1973.

The CDMG was preparing a geologic marine map of the State, including surface and subsurface coastal areas. Work was concentrated on the Bay Area, where sand and gravel were considered to be the most significant resources. A CDMG study of the Bay Area and lower delta indicated resources of 500 million cubic yards of medium-grained to coarse sand and 400 million tons of shell, accessible to dredges.

A project under consideration, conducted by the CDMG in cooperation with the Bay Area Planning Directors Association and the Rock, Sand and Gravel Producers Association of northern California, would assess the sand and gravel resources of the Bay Area, with the following objectives: (1) Determine reserves, (2) project estimated demand for concrete aggregate to the year 2000, and (3) analyze social, political, economic, and technological factors involved in meeting this demand from available resources.

Sodium Compounds.—Production of sodium carbonate (soda ash) and sodium sulfate (salt cake), principally by Kerr-McGee Chemical Corp. and Stauffer Chemical Co. at Searles Lake, San Bernardino County, was at a rate similar to that of 1971. Early in 1972, Kerr-McGee announced plans for building a new, $100 million soda ash plant.

Stone.—Although a larger number of quarries were reported in operation, quantities of stone marketed and used were 14% lower compared with 1971 data.

Table 14.—California: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alameda	12	10,497	14,497	13	8,746	11,988
Alpine	1	2	([1])	2	37	8
Amador	4	W	W	6	933	4,213
Butte	6	908	1,246	10	878	1,180
Contra Costa	4	411	503	6	400	351
Del Notre	4	190	218	5	214	W
El Dorado	3	W	W	6	189	210
Fresno	9	3,670	4,837	10	3,758	5,028
Glenn	5	430	794	6	356	433
Humboldt	16	530	888	12	545	881
Imperial	9	1,911	2,953	7	619	330
Inyo	11	307	568	8	236	400
Kern	18	3,098	4,299	18	2,178	3,511
Kings	--	9	25	1	21	40
Lake	8	248	331	11	332	460
Lassen	2	W	W	5	147	267
Los Angeles	25	21,678	28,739	28	21,306	29,303
Marin	1	([1])	([1])	2	3	6
Mariposa	5	139	399	4	39	68
Mendocino	16	327	457	13	403	582
Merced	8	2,383	2,799	6	1,249	1,656
Modoc	6	288	W	4	136	250
Mono	5	49	91	6	153	201
Monterey	10	683	2,673	10	689	2,590
Napa	3	52	112	2	W	W
Nevada	4	667	953	6	1,226	1,806
Orange	18	8,619	10,696	19	9,340	12,311
Placer	4	307	W	8	906	1,644
Plumas	3	W	W	6	93	79
Riverside	17	3,749	6,590	17	5,039	8,520
Sacramento	8	5,644	6,087	11	5,836	8,594
San Benito	5	470	981	4	W	W
San Bernardino	20	9,082	10,208	22	12,995	9,316
San Diego	29	11,573	21.481	29	9,813	20,326
San Joaquin	7	3,398	4,589	6	2,360	3,033
San Luis Obispo	4	159	W	6	278	636
Santa Barbara	6	1,190	1,569	8	1,536	1,780
Santa Clara	11	3,231	3,645	13	4,337	6,008
Santa Cruz	6	2,146	2,294	7	2,126	2,508
Shasta	14	587	677	17	824	937
Sierra	1	14	37	3	21	13
Siskiyou	5	107	W	7	474	499
Solano	3	29	W	1	86	285
Sonoma	8	3,138	4,211	12	3,213	4,933
Stanislaus	11	1,644	2,182	11	1,912	2,568
Tehama	6	188	213	7	164	217
Trinity	2	W	W	9	183	266
Tulare	6	1,424	2,038	6	1,069	1,530
Tuolumne	1	W	W	5	271	W
Ventura	8	4,872	4,842	10	4,430	4,608
Yolo	6	2,078	2,172	9	2,616	2,643
Yuba	4	591	579	5	742	871
Undistribued [2]	r 16	2,749	5,213	16	1,830	2,732
Total [3]	424	115,468	157,683	481	117,288	162,619

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Calaveras, Colusa, Madera, San Francisco, San Mateo, and Sutter Counties and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

Kaiser Refractories installed a new baghouse, the third designed by Kaiser Engineers, at the No. 3 kiln of its Natividad dolomitic limestone operation, Monterey County. The air-cleaning capacity of this baghouse was a volume of 100,000 cubic feet per minute at 500° F. The baghouse was equipped with 792 glass cloth filter bags in 12 compartments.

Premier Resources, Inc., mined dolomitic marble at several quarries near Keeler, Inyo County, and produced crushed products at an average rate of 100 tons per day at its crushing-screening plant. Four grades of crushed rock used in roofing, landscaping, and terrazzo, were sacked for domestic and export markets; the smallest, minus 60 mesh (white), constituted the bulk of sales. Architectural building stone was also marketed in a variety of sizes and colors.

Table 15.—California: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	W	W	223	1,095
Building	22,084	31,905	23,370	34,737
Engine	46	159	56	180
Fill	4,570	3,222	4,338	3,560
Foundry	115	569	113	586
Glass	W	W	878	4,547
Paving	14,085	17,687	17,507	23,313
Other uses [1]	4,798	10,922	1,197	6,077
Total [2]	45,700	64,462	47,681	74,096
Gravel:				
Building	24,922	35,505	23,334	35,278
Fill	1,839	1,242	1,590	1,356
Paving	28,497	36,983	29,964	40,990
Railroad ballast	276	246	W	W
Miscellaneous	525	758	689	938
Other uses	2,461	3,082	1,161	1,886
Total [2]	58,520	77,816	56,737	80,448
Government-and-contractor operations:				
Sand:				
Building	8	20	36	37
Fill	275	49	1,154	397
Paving	3,393	6,100	1,094	1,563
Other uses	6	6	2	4
Total [2]	3,682	6,175	2,285	2,000
Gravel:				
Building	4	18	77	139
Fill	325	68	6,599	862
Paving	7,235	9,139	3,906	5,069
Other uses	2	5	2	4
Total [2]	7,565	9,230	10,584	6,074
Total sand and gravel [2]	115,468	157,683	117,288	162,619

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes fire or furnace, glass, filtration, oil (hydrofrac), filler, molding, pottery, railroad ballast, and other sands.

[2] Data may not add to totals shown because of independent rounding.

Sulfur.—Recovery of sulfur (at least 97% purity) by 10 oil and chemical companies continued an upward trend, increasing to 31% more than that of 1971, and reached a sales value of $5.1 million. Stauffer Chemical Co., Los Angeles County, was the leading producer, followed by Union Oil Co. operations in Contra Costa and San Luis Obispo Counties.

Shipments of hydrogen sulfide (H_2S) and sulfur dioxide (in terms of sulfur content) increased 20% over the 1971 rate. Standard Oil Co. of California accounted for 80% of these shipments at the Richmond (Contra Costa County) and El Segundo County plants, where H_2S was produced by the Girbotol process.

Talc and Pyrophyllite.—Output of crude and prepared talc showed a slight increase over that of 1971. There were 14 companies with 25 operations, including a single pyrophyllite producer (International Pipe and Ceramics Corp. at Victorville, San Bernardino County). The leading talc producer was L. Grantham Corp., Warm Springs mine, southwestern Death Valley, Inyo County. In May, the Grantham mine and mill facilities, including Desert Mines, Inc., of Laguna Beach, Orange County, and American Mineral Co. of Los Angeles, were acquired by Johns-Manville Corp.

Sales of prepared product totaled 176,358 tons, valued at $6.3 million, for use in ceramics (42%), paint (18%), insecticides (11%), and various minor applications, and for the export market.

Vermiculite.—Production and sales of exfoliated vermiculite, derived from crude out-of-State vermiculite, was nearly 7% lower compared with 1971 figures. California Zonolite Co., a division of W. R. Grace & Co., with exfoliating plants at Newark,

Table 16.—California: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972			Kind of stone produced in 1972
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Alameda	5	1,871	2,355	8	2,638	3,588	Limestone, sandstone, traprock, other stone.
Colusa	1	W	W	1	35	121	Sandstone.
Contra Costa	9	2,849	5,853	7	1,902	3,955	Sandstone, traprock, other stone.
Del Norte	4	41	46	8	W	W	Granite, sandstone, other stone.
El Dorado	7	W	1,664	8	377	W	Limestone, other stone.
Fresno	6	53	100	19	W	W	Limestone, granite, other stone.
Humboldt	8	242	W	10	99	113	Other stone.
Imperial	2	W	W	3	24	91	Granite, other stone.
Kern	14	2,984	4,011	13	2,975	4,314	Limestone, quartz, quartzite, other stone.
Kings	--	--	--	1	1	2	Other stone.
Lake	6	11	25	7	W	19	Traprock, other stone.
Lassen	1	W	W	2	276	W	Do.
Los Angeles	15	1,346	3,013	8	1,586	2,952	Granite, sandstone, other stone.
Mariposa	1	1	12	4	1	13	Slate, granite.
Mendocino	3	W	W	2	3	5	Traprock.
Modoc	4	84	150	6	188	206	Sandstone, traprock, other stone.
Nevada	3	57	193	5	W	W	Quartz, quartzite.
Plumas	1	W	W	4	141	219	Granite, marble, other stone.
Riverside	10	1,614	4,625	15	2,492	3,948	Limestone, granite, quartzite, traprock.
San Bernardino	36	8,524	16,058	30	6,770	11,300	Limestone, dolomite, granite, sandstone, quartz, quartzite, traprock, other stone.
San Diego	19	1,923	4,118	14	1,689	3,981	Granite, traprock.
San Mateo	6	1,176	1,713	6	749	1,507	Limestone, sandstone, traprock, other stone.
Santa Clara	7	W	W	12	W	5,089	Limestone, granite, sandstone, other stone.
Santa Cruz	5	1,287	2,346	6	W	W	Limestone, granite.
Siskiyou	3	64	132	12	141	211	Traprock, other stone.
Solano	8	35	85	6	W	W	Sandstone, traprock.
Sonoma	6	482	707	10	426	734	Sandstone, shell, traprock.
Stanislaus	1	W	W	1	93	246	Other stone.
Tehama	6	27	50	--	--	--	
Tulare	2	380	330	2	W	W	Other stone.
Tuolumne	15	627	4,287	14	92	464	Dolomite, marble, sandstone, other stone.
Ventura	9	851	2,453	8	466	1,716	Limestone, granite, sandstone, traprock, other stone.
Yuba	6	65	274	4	W	185	Traprock, other stone.
Undistributed[1]	91	16,842	31,656	97	14,051	20,832	
Total[2]	320	43,336	86,255	353	37,213	65,811	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Alpine, Amador, Calaveras, Glenn (1971), Inyo, Madera, Marin, Merced (1971), Monterey, Napa, Orange (1971), Placer, Sacramento, San Benito, San Joaquin, San Luis Obispo, Santa Barbara, Shasta, Trinity, and Yolo (1972) Counties, and counties for which no breakdown is available.

[2] Data may not add to totals shown because of independent rounding.

Table 17.—California: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Dimension:				
Granite	5	345	5	329
Sandstone and quartzite	W	W	1	23
Traprock	([1])	3	([1])	2
Other stone	19	W	[2]17	[2]138
Slate	1	12	W	13
Undistributed [2]	9	435	--	--
Total [3]	34	796	24	503
Crushed and broken:				
Limestone and dolomite	23,275	44,115	18,058	29,270
Granite	5,919	12,584	5,337	9,604
Marble [4]	W	W	192	368
Marl	54	W	--	--
Sandstone	4,263	9,288	5,097	10,164
Quartzite [5]	309	739	221	580
Traprock	2,555	6,630	4,068	7,548
Other stone	6,784	11,421	4,217	7,774
Undistributed [6]	144	782	--	--
Total [3]	43,302	85,459	37,190	65,307

W Withheld to avoid disclosing individual company confidential data.

[1] Less than ½ unit.

[2] Includes data for limestone, and any data with symbol "W" in dimension stone.

[3] Data may not add to totals shown because of independent rounding.

[4] Data include shell.

[5] Data include quartz.

[6] Data include shell and slate, and any data with symbol "W" in crushed and broken stone.

Table 18.—California: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Dimension:				
Rough blocks	W	W	8	261
Rough construction	18	W	11	83
Dressed architectural	W	W	1	31
Dressed construction	W	W	2	26
Dressed flagging	W	W	1	17
Other uses [1]	16	796	1	85
Total	34	796	24	503
Crushed and broken:				
Bituminous aggregate	2,422	7,350	2,628	6,185
Concrete aggregate	4,124	6,867	3,460	5,017
Dense graded roadbase stone	11,521	18,863	8,253	13,373
Macadam aggregate	162	397	W	W
Surface treatment aggregate	269	734	695	850
Unspecified construction aggregate and roadstone	1,829	3,978	2,285	3,917
Agricultural purposes [2]	148	864	155	960
Cement manufacture	14,810	20,715	12,981	15,384
Fill	W	W	455	559
Glass	248	1,587	233	1,355
Lime manufacture	252	881	465	1,434
Riprap and jetty stone	2,185	5,384	2,499	6,300
Stone sand	75	370	59	552
Sugar refining	250	715	216	W
Terrazzo and exposed aggregate	20	315	51	412
Other uses [3]	4,987	16,441	2,757	9,009
Total [4]	43,302	85,459	37,190	65,307
Grand total [4]	43,336	86,255	37,213	65,811

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes stone used for monumental purposes, flagging, and uses not specified; 1972 data also include stone used for curbing and architectural roofing slate.

[2] Includes agricultural limestone, agricultural marl and other soil conditioners, and poultry grit and mineral food.

[3] Includes railroad ballast, alter stone, dead-burned dolomite, ferrosilicon, flux stone, refractory stone, asphalt filler, whiting, other fillers, building products, magnesia (1971), magnesium metal manufacture (1972), roofing aggregates, chips, and granules, uses not specified, and other crushed and broken stone in smaller quantities.

[4] Data may not add to totals shown because of independent rounding.

Alameda County, and Los Angeles, Los Angeles County, accounted for more than 90% of the output. The material was used (in order of importance) in acoustical-fireproofing materials, concrete and plaster aggregates, fertilizers, horticulture, and miscellaneous applications.

METALS

Copper.—A byproduct copper concentrate of Union Carbide Corp. at Pine Creek, Inyo County, continued to comprise essentially the entire copper output in the State. Exploration for copper appeared to have diminished during the year.

Slow sales, low prices, and little export business for copper and brass scrap prevailed during the latter part of the year in the San Francisco and Los Angeles markets.

Gold.—Output showed a marked increase, compared with that of 1971, owing to increased activity at lode and placer operations. Byproduct and coproduct lode gold were produced at five operations. Placer gold was produced at 19 properties, 15 of which were as a byproduct of sand and gravel operations.

Interest in exploration for gold was spurred by high prices prevailing during the year. According to the Office of Minerals Exploration (OME), USGS, at Menlo Park, there was also renewed interest in OME assistance in gold exploration. An OME project was underway by American Primary Resources, Inc., at the Brown Bear mine, near Lewiston, Trinity County, where numerous claims were consolidated and, late in the year, 2,000 feet of underground workings had been reopened. Another OME project was started at the Lucky Jack mine in the Granite Basin area, Plumas County

Table 19.—California: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing[1]		Material sold or treated[2] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1970, total	15	6	[r] 105,261	4,999	$181,912	451,150	$798,905
1971, total	8	5	89,757	2,966	122,351	443,761	686,055
1972:							
Del Norte	--	1	--	3	176	--	--
Fresno	--	--	--	494	28,948	68	114
Los Angeles	--	--	--	57	3,340	7	12
Merced	--	--	--	35	2,051	3	5
Plumas	--	1	--	8	469	--	--
San Joaquin	--	--	--	620	36,332	59	99
Shasta	--	--	--	76	4,454	8	13
Sierra	--	1	--	6	352	--	--
Stanislaus	--	--	--	301	17,638	29	49
Tulare	--	--	--	71	4,161	9	15
Undistributed[3]	5	1	18,005	2,303	134,955	175,284	295,354
Total	5	4	18,005	3,974	232,876	175,467	295,661

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1970, total	2,308	$2,663,374	1,772	$553,381	3,514	$1,076,727	$5,274,299
1971, total	515	535,704	2,284	630,356	3,003	967,016	$2,941,482
1972:							
Del Norte	--	--	--	--	--	--	176
Fresno	--	--	--	--	--	--	29,062
Los Angeles	--	--	--	--	--	--	3,352
Merced	--	--	--	--	--	--	2,056
Plumas	--	--	--	--	--	--	469
San Joaquin	--	--	--	--	--	--	36,431
Shasta	--	--	--	--	--	--	4,467
Sierra	--	--	--	--	--	--	352
Stanislaus	--	--	--	--	--	--	17,687
Tulare	--	--	--	--	--	--	4,176
Undistributed[3]	598	612,246	1,153	346,736	1,202	426,768	1,816,059
Total	598	612,246	1,153	346,736	1,202	426,768	1,914,287

[r] Revised.

[1] Operations from which gold and silver are recovered as byproducts from sand and gravel operations not counted as producing mines.

[2] Does not include gravel washed.

[3] Alpine, Inyo, Mono, Placer, Sacramento, and San Diego Counties combined to avoid disclosing individual company confidential data.

Table 20.—California: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1972, by type of material processed and method of recovery

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Amalgamation	210	1,050	--	--	--
Smelting of concentrates [1]	928	135,722	553	553	1,010
Direct smelting of ore and copper precipitates [2]	14	38,447	45	600	192
Total lode material	1,152	175,219	598	1,153	1,202
Placer	2,822	248	--	--	--
Grand total	3,974	175,467	598	1,153	1,202

[1] Includes byproduct recovery from tungsten ore.
[2] Combined to avoid disclosing individual company confidential data.

Table 21.—California: Mine production (recoverable) of gold, silver, copper, lead, and zinc in 1972, by class of ore or other source material

Source	Number of mines [1]	Material sold or treated [2] (short tons)	Gold (troy (ounces)	Silver (troy (ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold, gold-silver [3]	2	4,755	951	33,926	(4)	3	3
Lead-zinc, zinc, copper precipitates, tungsten ore [3]	3	[5]13,250	201	141,293	598	1,150	1,199
Total lode material	5	18,005	1,152	175,219	598	1,153	1,202
Placer	4	--	2,822	248	--	--	--
Grand total	9	18,005	3,974	175,467	598	1,153	1,202

[1] Operations from which gold and silver are recovered as byproducts from sand and gravel operations not counted as producing mines.
[2] Does not include gravel washed.
[3] Combined to avoid disclosing individual company confidential data.
[4] Less than ½ unit.
[5] Excludes tungsten ore tonnage.

Iron Ore and Concentrate.—Lower volume operations of Kaiser Steel Corp. at the Eagle Mountain mine, Riverside County, resulted in a 22.5% reduction in output of iron ore compared with that of 1971. This reduction was planned following termination of export sales to Japan. Mining and production operations were suspended for about 1 month in order to reduce stockpiles to levels sustaining normal shipments to the company's steelworks at Fontana, San Bernardino County. Improved dust control equipment was installed at the mine.

Shipments to Fontana in 1972 were as follows (net dry long tons): Lump ore, 576,324; fines, 395,310; and pellets, 1,916,905. Cleanup ore and pellets in stockpile at the Long Beach and Los Angeles ports were shipped to Japan.[11]

Standard Slag Co. made eight shipments, totaling 407,894 long tons, from the Beck deposit, San Bernardino County, to Nippon Steel Corp., Japan, during 1972. The mine product was a concentrate containing 60% Fe, obtained by magnetic separation of magnetite-hematite ore. The company had a 5-year contract for delivery of 492,000 long tons per year. In addition, fines were shipped for domestic use.[12]

Iron Oxide.—A major expansion, involving several million pounds of oxide production, was completed by Pfizer Inc. at its Emeryville plant. Products were yellow, black, and red oxides for use in paints, plastics, concrete products, and other compounding industries. The expansion included facilities for in-process recycling and conversion of recovered solids to useful raw materials.

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[11] Skillings' Mining Review. Kaiser Iron Ore Shipments Total 2,909,477 Gross Tons in 1972. V. 62, No. 16, Apr. 21, 1973, p. 23.
[12] Skillings' Mining Review. The Standard Slag Co. Beck Mine in Southern California During 1972 Marks Initial Year of Production of High-Grade Iron Ore for Export to Japan. V. 62, No. 3, Jan. 20, 1973, pp. 1, 12-15.

Iron and Steel.—Production of crude steel and mill products by Kaiser Steel Corp. at Fontana, San Bernardino County was affected by a strike involving 6,800 production and maintenance workers from February 1 to March 15, 1972. According to the company's annual report for 1972, annual steelmaking capacity was increased from 2.9 million to 3.4 million tons, largely by increasing the ratio of pellets (from the Eagle Mountain mine) to other ores and concentrates. Relining of the four blast furnaces, which was started in 1971, was completed. Modern hot-strip coil loading facilities were installed for servicing trains transporting coils to General Motors Corp. under a contract effective in April. Later in the year, Kaiser Steel approved a $2.5 million program to rebuild and modernize the two oldest of seven coke-oven batteries at Fontana, enabling the company to maintain or improve control of emissions. At yearend, the corporation was operating on variances, granted by the San Bernardino County Pollution Control District, for its coke ovens and basic oxygen steelmaking plant.

United States Steel Corp. announced a major expansion and modernization of its rod mill at Pittsburg, Contra Costa County. Annual capacity was to be increased 30%.

Slag.—Kaiser Steel announced 100% utilization of blast furnace slag, formerly stockpiled at Fontana. International Mill Services used this material in producing crushed and screened, iron-free chip for landscaping and roofing granule, railroad ballast, and standard aggregate. The production rate was 1.5 million tons per year, and expansion was underway.

Scrap.—In mid-year the ferrous scrap market in the San Francisco Bay Area was weak, and there was little export activity. No. 1 heavy melting scrap was selling for $26–$27 per ton. As the year progressed, the market improved steadily and prices strengthened. At yearend, there was a new wave at Japanese buying, and the price for No. 1 heavy melting scrap reached $38–$41 per ton, with some sales of premium grades at $43–$44 per ton. A prevailing shortage of rail cars for transport of scrap to docks had a dampening effect on the market. The Los Angeles market was parallel to that in San Francisco but at slightly lower quoted prices.

Lead-Zinc.—Production was curtailed substantially, compared with that of 1971, owing to closure of the Darwin mine, Inyo County, in April. The Thompson mine workings above the 400 level and mill tailings in the Darwin area were leased by Montecito Minerals Corp., which planned to produce a bulk sulfide flotation concentrate, containing lead and zinc, for shipment to American Smelting and Refining Co. (ASARCO) at El Paso, Tex., from a new mill under development.

The equipment and buildings of the ASARCO lead smelter at Selby, Contra Costa County, which was closed at the end of 1971, were sold at public auction in April. The company also sought a buyer for the land, which borders on San Pablo Bay, a part of San Francisco Bay.

Manganese.—Ocean Mining Div., Hughes Tool Co., in conjunction with Lockheed Missiles and Space Co., established a research plant at Redwood City, San Mateo County, for development of a manganese nodule mining operation from the ocean floor.

Mercury.—A continuing decline in mercury-mining activity was attributed to reduced demand and soft prices caused by environmental problems and the banning of mercury for certain uses. There were 14 producing mines, only five of which remained active at yearend. The eight principal producers (Table 23) accounted for 95% of total output during 1972.

In May, the price for mercury, per 76-pound flask, had declined to $150, compared with a high price of $520 in 1970. Later in the year, the price strengthened, reaching $285 in December.

Rare-Earth Minerals.—According to the annual report of Molybdenum Corp. of America (Molycorp), production of rare-earth oxides (REO) in bastnaesite concentrate at Mountain Pass, San Bernardino County, increased to 23.6 million pounds, 9% higher than that of 1971. This increased output was attributed to growing demand for the rare-earth elements, particularly for alloying in high-strength steels for oil and gas pipelines. During 1972, an expansion program at the bastnaesite concentrating plant, Mountain Pass, included new flotation cells and a new barite circuit. Late in the year, Molycorp announced plans for

Table 22.—California: Mercury production, by method of recovery

Year	Operating mines	Recovery method				Unclassified (76-pound flasks)[1]	Total	
		Furnaced		Retorted				
		Ore treated (short tons)	76-pound flasks	Ore treated (short tons)	76-pound flasks		76-pound flasks	Value[2] (thousands)
1968	53	[3] 176,502	19,494	40,380	1,918	5	21,417	$11,470
1969	72	[3] 215,495	16,093	37,199	2,387	W	18,480	9,333
1970	51	[3] 222,495	17,587	15,005	547	459	18,593	7,582
1971 [r]	39	[3] 131,120	12,485	19,089	698	306	13,489	3,944
1972	14	58,228	5,788	W	W	W	5,788	1,263

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Furnaced."

[1] Includes mercury recovered from old surface ores, dumps, and placers.

[2] Value calculated at average New York price.

[3] Includes ore and mercury from dumps not separable.

Table 23.—California: Principal producing mercury mines in 1972

County	Operator	Mine	Remarks
Marin	Mercury Fox, Ltd	Chileno Valley	Mine operated intermittently; shaft entry to workings at 125 level and below.
Napa	Morgan North Mine Management Co.	Knoxville	30-ton-per-day furnace. Leading producer in 1972. Shipments from new open pit and stockpile.
San Benito	New Idria Mining and Chemical Co.	New Idria	Underground and surface mining. Mine closed end of May after nearly continuous operation since 1854; placed on standby basis.
San Luis Obispo	Buena Vista Mines, Inc.	Buena Vista	30-ton-per-day furnace. Underground mine.
Santa Clara	Guadalupe Mining Co.	Guadalupe	New 100-ton-per-day furnace. Underground mine; intermittent operation by lessee on royalty basis.
Do	Santa Clara Quicksilver Co.	New Almaden	Intermittent underground mining by lessee in several areas; also processed mine dump material.
Sonoma	Sonoma Mines, Inc.	Mt. Jackson	100-ton-per-day furnace. Underground operation; mine closed in March.
Do	Sulphur Creek Mining Co.	Culver-Baer	Surface mining.

continuing expansion to 60 million pounds REO per year in 1973.

Silver.—Production was reduced substantially, compared with that of 1971. The Darwin mine, Inyo County, a major producer, was closed in April. Later in the year, sections of the Thompson workings of this mine above the 400 level were leased to Montecito Minerals Corp., which conducted studies on processing the ore, was building a 200-ton-per-day mill, and planned to ship a bulk sulfide flotation concentrate to ASARCO at El Paso, Tex. Other major producers were Union Carbide Corp. at its Pine Creek custom mill, Inyo County, and Santa Rosa Mining Association at the Santa Rosa mine, also in Inyo County.

Exploration and development continued at the Zaca mine, Alpine County, leased from Siskon Corp., Reno, Nev., by C. B. Lovestedt, who stockpiled and shipped precious metal ores.

Tungsten.—Tungsten production was slightly above that of 1971. There were only 12 producing companies, compared with 29 in 1971. California continued as the principal producing State, accounting for 76% of U.S. output. Union Carbide Corp. reported increased output during the year and again produced a large share of total State output at its Pine Creek mine, Inyo County. Union Carbide was engaged in environmental improvements to meet State Water Quality Control Board regulations. A water-clarifying chemical system, in which a flocculant-coagulant causes settling of solid materials in mine water effluent to Pine Creek, went on-stream late in the year, and a new plant for recovery of sodium sulfate and other dissolved solids from ammonium paratungstate circuit effluents was under construction. An environmental monitoring system was maintained along Pine Creek for surveillance of water quality.

Montecito Mineral Corp. completed construction of a 200-ton-per-day mill in the Darwin mining district, Inyo County, and, toward the end of the year, was making trial runs at the mill. The company planned to upgrade tungsten-bearing tailings from the nearby Defiance mill, but this project proved unsuccessful because the scheelite was too fine for table recovery. Montecito leased the nearby Thompson mine above the 400 level and trucked the ore 1 mile to its mill, where an impure tungsten-lead-silver bulk concentrate was recovered by gravity tabling.

Mines Exploration, Inc., built a 200-ton-per-day flotation-gravity-leach mill, which went into operation in October at Atolia, San Bernardino County. Mill tailings from the nearby Paradox mining area were processed on a trial basis. The company was planning to ship a 60% WO_3 concentrate to Kennametal, Inc., Fallon, Nev.

Teledyne Wah Chang Corp. leased the Strawberry mine, Madera County, in June and conducted a diamond drilling exploration program and development work at the Nos. 1 and 4 shafts.

Uranium.—An agreement was concluded with the U.S. Atomic Energy Commission (AEC) for a cooperative environmental program at and near nuclear powerplants in the State. The program involved radiation monitoring and effluent water sampling. The Humbolt Bay, Diablo Canyon, Rancho Seco, and San Onofre nuclear plant sites were included in the project.

Gulf General Atomic Co., San Diego, announced an agreement with Southern California Edison Co. for two 770-megawatt, high-temperature, gas-cooled reactors (HTGR) proposed for an undertermined site in the eastern California desert. The fuel for the HTGR would be fissionable uranium$_{235}$ mixed with fertile thorium$_{232}$.

The Sierra Club filed suit against PG&E, the State Resources Agency, and the Secretary for Resources concerning the proposed nuclear power station near Point Arena, Mendocino County. The Club sought complete environmental impact studies before license for construction was granted. In October, PG&E agreed to conduct additional studies.

Late in the year, a group from Sacramento petitioned the AEC for a public hearing on the Sacramento Municipal Utility District's application for license to operate the nuclear powerplant at Rancho Seco, 25 miles east of Sacramento.

Table 24.—Principal producers

Commodity and company	Address	Type of activity	County
Asbestos:			
Atlas Asbestos Co	P.O. Box 805 Coalinga, Calif. 93210	Open pit mine	Fresno.
Coalinga Asbestos Co	P.O. Box 1045 Coalinga, Calif. 93210	do	Do.
Pacific Asbestos Corp	P.O. Box 127 Copperopolis, Calif. 95228	do	Calaveras.
Union Carbide Corp	P.O. Box K King City, Calif. 93930	do	San Benito.
Barite: Industrial Minerals Co	1057 Commercial St. San Carlos, Calif. 94070	do	Shasta.
Boron minerals and compounds:			
Kerr-McGee Chemical Corp	OMB-508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines	San Bernardino.
Stauffer Chemical Co	636 California St. San Francisco, Calif. 94119	do	Do.
Tenneco, Inc	Tenneco Bldg. Houston, Tex. 77002	Open pit mine	Inyo.
U.S. Borax & Chemical Corp.	P.O. Box 75128, Stanford Station Los Angeles, Calif. 90005	do	Inyo and Kern.
Bromine and compounds: Kerr-McGee Chemical Corp.	OMB-508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines	San Bernardino.
Calcium-magnesium chloride:			
Leslie Salt Co	P.O. Box 364 Newark, Calif. 94560	do	Do.
National Chloride Co. of America.	Suite 803, Wilflower Bldg. 615 South Flower St. Los Angeles, Calif. 90017	do	Do.
Carbon dioxide: Standard Oil Co.	225 Bush St. San Francisco, Calif. 94120	Natural gasoline processing plant.	Kern.
Cement:			
American Cement Corp	2404 Wilshire Blvd. Los Angeles, Calif. 90057	Dry process portland cement plants.	Riverside and San Bernardino.
Calaveras Cement Div., The Flintkote Co.	215 Market St. San Francisco, Calif. 94104	Wet and dry process portland cement plants.	Calaveras and Shasta.
California Portland Cement Co.	800 Wilshire Blvd. Los Angeles, Calif. 90017	Dry process portland cement plants.	Kern and San Bernardino.
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Wet process portland cement plants.	San Benito and San Mateo.
Kaiser Cement & Gypsum Corp.	300 Lakeside Dr. Oakland, Calif. 94612	do	San Bernardino and Santa Clara.
Monolith Portland Cement Co.	3326 San Fernando Rd. Los Angeles, Calif. 90065	Wet process portland cement plants.	Kern.
Lone Star Industries, Inc	400 Alabama St. San Francisco, Calif. 94110	Dry process portland cement plant.	Santa Cruz.
General Portland, Inc	3810 Wilshire Blvd. Los Angeles, Calif. 90005	do	Kern.
Southwestern Portland Cement Co.	1034 Wilshire Blvd. Los Angeles, Calif. 90017	Wet and dry process portland cement plant.	San Bernardino.
Clays and shale:			
Amcor, Inc., Riverside Cement Co.	P.O. Box 832 Riverside, Calif. 92501	Open pit mine	Orange, Riverside, San Bernardino.
Basalt Rock Co., Inc	8th and River Sts. Napa, Calif. 94458	do	Napa.
Calaveras Cement Div., The Flintkote Co.	San Andreas, Calif. 95249	do	Amador, Calaveras, Shasta.
Crestlite Inc., Div. of Susquehanna Corp.	Camino De Estrella San Clemente, Calif. 92672	do	Orange.
Interpace Corp	2901 Los Feliz Blvd. Los Angeles, Calif. 90039	do	Amador, Placer, Riverside, San Bernardino, Sutter, Yuba.

Table 24.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays and shale—Continued			
Kaiser Industries Corp	300 Lakeside Drive Oakland, Calif. 94612	Open pit mine	Alameda.
Lightweight Processing Co	650 South Grand Ave. Los Angeles, Calif. 90017	do	San Bernardino and Ventura.
Pacific Clay Products, Inc	1255 West 4th St. Los Angeles, Calif. 90017	do	Amador, Orange, Riverside.
Port Costa Products Co	P.O. Box 5 Port Costa, Calif. 94569	do	Contra Costa.
Southwestern Portland Cement Co.	1034 Wilshire Blvd. Los Angeles, Calif. 90017	do	San Bernardino.
Coal (lignite): Alpco Div., of Interpace Corp.	P.O. Box 787 Ione, Calif. 95640	Strip mine	Amador.
Copper: Union Carbide Corp., Mining & Metals Div.	270 Park Ave., 38th Floor New York, N.Y. 10017	Underground mine.	Inyo.
Diatomite:			
GREFCO, Inc	630 Shatto Pl. Los Angeles, Calif. 90005	Open pit mine	Santa Barbara.
Johns-Manville Products Corp., Celite Div.	Lompoc, Calif. 93436	do	Do.
Feldspar:			
Wedron Silica Co	P.O. Box 150 Pacific Grove, Calif. 93950	do	Monterey.
Owens-Illinois, Inc	P.O. Box 1035–1036 Toledo, Ohio 43601	do	Do.
Gold:			
Claude B. Lovestedt	P.O. Box 1496 Carson City, Nev. 89701	do	Alpine.
Santoni & Santoni	5078 West Shields Fresno, Calif. 93705	Byproduct recovery.	Fresno, Merced, Sacramento, San Joaquin, Shasta, Stanislaus, Tulare.
Gypsum:			
H. M. Holloway, Inc	714 6th St. Wasco, Calif. 93280	Open pit mine	Kern.
Temblor Gypsum Co	Carrisa Plains, Star Route Box 80 Santa Margarita, Calif. 93453	do	Do.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Open pit mine and calcining plant.	Imperial.
Iron ore:			
Kaiser Steel Corp	P.O. Box 158 Eagle Mountain, Calif. 92241.	Open pit mine	Riverside.
Lead: Darwin Mines Mexicanus, Colorado, Inc.	Box 206 Darwin, Calif. 93522	Underground	Inyo.
Lime:			
American Crystal Sugar Co	Box 419 Denver, Colo. 80201	Shaft kiln	Yolo.
Diamond Springs Lime Co.	P.O. Box 407 Diamond Springs, Calif. 95619	Rotary kiln and continuous hydrator.	El Dorado.
Flintkote Co	P.O. Box 57367 Flint Station Los Angeles, Calif. 90057	Shaft and rotary kilns, continuous hydrator.	Contra Costa and Tuolumne.
Holly Sugar Corp	Box 1052 Colorado Springs, Colo. 80901	Shaft kilns and continuous hydrator.	Glenn, Imperial, Orange, San Joaquin.
Kaiser Aluminum & Chemical Corp.	Moss Landing, Calif. 95039	Rotary kiln and continuous hydrator.	Monterey.
Pfizer, Inc	P.O. Drawer AD Victorville, Calif. 92392	Fluidized-bed kiln and continuous hydrator.	San Bernardino.
Stauffer Chemical Co	636 California St. San Francisco, Calif. 94119	Rotary kiln and continuous hydrator.	Do.
Union Sugar Div	230 California St. San Francisco, Calif. 94111	Shaft kiln	Santa Barbara.

Table 24.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Lithium minerals: Kerr-McGee Chemical Corp.	OMB-508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines.	San Bernardino.
Magnesium compounds:			
FMC Corp	P.O. Box 344 Newark, Calif. 94560	Salt works bitterns.	San Diego.
Kaiser Aluminum & Chemical Corp.	Moss Landing, Calif. 95039	Sea water processing.	Monterey.
Merck & Co., Inc	Rahway, N.J. 07065	do	San Mateo.
Mercury:			
Buena Vista Mines, Inc	P.O. Box 753 Paso Robles, Calif. 93446	Underground mine.	San Luis Obispo.
Guadalupe Mining Co	14900 Guadalupe Mine Rd. San Jose, Calif. 95120	do	Santa Clara.
Mercury Fox, Ltd	415 7th St. Petaluma, Calif. 94952	Open pit mine.	Marin.
Morgan North Mine Management Co.	1050 Parker St. Berkley, Calif. 94710	do	Napa.
New Idria Mining and Chemical Co.	3457 South Cedar Fresno, Calif. 93745	Open pit and underground mines.	San Benito and Santa Clara.
Santa Clara Quicksilver Co.	21731 Almaden Rd. San Jose, Calif. 95120	Underground mine.	Santa Clara.
Sonoma Mines, Inc	P.O. Box 226 Guerneville, Calif. 95446	do	Sonoma.
Sulphur Creek Mining	201 Ridge Rd. Ukiah, Calif. 95482	do	Do.
Molybdenum: Union Carbide Corp., Mining & Metals Div.	270 Park Ave., 38th Floor New York, N.Y. 10017	do	Inyo.
Natural gas liquids:			
Atlantic Richfield Co	445 South Figueroa St. Los Angeles, Calif. 90054	Natural gasoline plants.	Kern, Santa Barbara, Ventura.
Standard Oil Co. of California.	225 Bush St. San Francisco, Calif. 94120	do	Fresno, Kern, Kings, Los Angeles, Orange, Santa Barbara, Ventura.
Union Oil Co. of California	P.O. Box 7600 Los Angeles, Calif. 90054	do	Fresno, Kern, Los Angeles, Orange, Santa Barbara, Ventura.
Peat:			
American Modoc Corp	P.O. Box 8402 Stockton, Calif.	Moss	Modoc.
Delta Humas Co	P.O. Box 89 Holt, Calif.	Reed-sedge bog.	San Joaquin.
Peter J. Gambetta	Route 1, Box 78 Brentwood, Calif. 94513	do	Contra Costa.
Perlite (crude): American Perlite Co.	11831 Vose St. North Hollywood, Calif. 91605	Open pit mine.	Inyo.
Perlite (expanded):			
Harborlite Corp	P.O. Box 458 Escondido, Calif. 92025	Plant	San Diego.
Paramount Perlite Co., Inc.	16236 S. Illinois P.O. Box 83 Paramount, Calif. 90723	do	Los Angeles.
Redco, Inc	11831 Vose St. North Hollywood, Calif. 91605	do	Do.
Petroleum:			
Atlantic Richfield Co	5900 Cherry Ave. Long Beach, Calif. 90805	Oilfields	Kern, Los Angeles, Orange, San Luis Obispo, Santa Barbara, Ventura.
Belridge Oil Co	1300 West 4th St. Los Angeles, Calif. 90017	do	Kern and Santa Barbara.
Chanslor-Western Oil & Development Co.	4549 Produce Plaza Los Angeles, Calif. 90058	do	Kern, Los Angeles, Orange, Ventura.
Continental Oil Co	Box 2197 Houston, Tex. 77001	do	Various.

Table 24.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum—Continued			
Getty Oil Co	3810 Wilshire Blvd. Los Angeles, Calif. 90005	Oilfields	Fresno, Kern, Los Angeles, Monterey, Orange, Riverside, San Bernardino, Santa Barbara, Ventura.
Gulf Oil Co	5400 Rosedale Hwy. Bakerfield, Calif. 93302	do	Fresno, Kern, Los Angeles, Orange, Santa Barbara, Ventura.
Long Beach (City of), Dept. of Oil Properties.	925 Harbor Plaza Long Beach, Calif. 90801	do	Los Angeles.
Mobil Oil Corp	612 South Flower St. Los Angeles, Calif. 90017	do	Fresno, Kern, Kings, Los Angeles, Monterey, Orange, San Benito, San Luis Obispo, Santa Barbara, Ventura.
Shell Oil Co	1008 West 6th St. Los Angeles, Calif. 90017	do	Contra Costa, Fresno, Kern, Los Angeles, Orange, San Benito, Santa Barbara, Ventura.
Signal Oil and Gas Co	1010 Wilshire Blvd. Los Angeles, Calif. 90017	do	Fresno, Kern, Los Angeles, Orange, San Luis Obispo, Santa Barbara, Ventura.
Standard Oil Co. of California.	225 Bush St. San Francisco, Calif. 94120	do	Contra Costa, Fresno, Kern, Kings, Los Angeles, Orange, San Luis Obispo, Santa Barbara, Ventura.
Texaco, Inc	3350 Wilshire Blvd. Los Angeles, Calif. 90005	do	Fresno, Kern, Los Angeles, Monterey, Orange, Santa Barbara, Ventura.
Union Oil Co. of California.	461 South Boylston Los Angeles, Calif. 90017	do	Fresno, Kern, Los Angeles, Orange, San Luis Obispo, Santa Barbara, Ventura.
Potassium salts: Kerr-McGee Chemical Corp.	OMB-508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines.	San Bernardino.
Pumice:			
Aiken Builders Products	P.O. Box 878 Las Vegas, Nev. 89101	Open pit mine	Do.
Cinder Products Co	3450 Lakeshore Ave. Oakland, Calif. 94610	do	Lake.
Glass Mountain Block, Inc	Redding Highway Alturas, Calif. 96101	do	Siskiyou.
Red Lava Products of California.	Star Rte. Clearlake, Calif. 95423	do	Lake.
Shastalite Cinder Co	P.O. Box 341 Weed, Calif. 96094	do	Siskiyou.

Table 24.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Rare-earth metals: Molybdenum Corp. of America.	Mountain Pass via Nipton, Calif. 92366	Open pit mine	San Bernardino.
Salt:			
Leslie Salt Co	505 Beach St. San Francisco, Calif. 94111	Solar evaporation and open pit mine.	Alameda, Napa, San Bernardino, San Mateo.
Metropolitain Water Dist. of Southern California.	P.O. Box 54153 Los Angeles, Calif. 90054	Solar evaporation.	San Bernardino.
Pacific Salt & Chemical Co	4262 Wilshire Blvd. Los Angeles, Calif. 90021	do	Do.
Standard Salt & Chemical Co.	Suite 803, Wilflower Bldg. 615 South Flower St. Los Angeles, Calif. 90017	do	Do.
Western Salt Co	P.O. Box 149 San Diego, Calif. 92112	do	Kern and San Diego.
Sand and gravel:			
Azusa Western, Inc	P.O. Box 575 Azusa, Calif. 91702	Open pit mine	Los Angeles.
California Rock and Gravel Co.	55 New Montgomery St. San Francisco, Calif. 94105	do	Alameda.
Conrock Co	Box 2950, Terminal Annex Los Angeles, Calif. 90051	do	Los Angeles, Orange, San Bernardino.
The Flintkote Co., Associated Rock Div.	P.O. Box 416 Upland, Calif. 91786	do	Los Angeles, Orange, San Bernardino, Ventura.
Kaiser Industries Corp	300 Lakeside Dr. Oakland, Calif. 94612	do	Alameda, Contra Costa, Glenn, Santa Clara, Santa Cruz, Sonoma.
Livingston-Graham, Inc	5500 North Peck Rd. El Monte, Calif. 91731	do	Los Angeles, Orange, San Bernardino, Ventura.
Owl Rock Products Co	P.O. Box 47 Irwindale, Calif. 91707	do	Fresno, Los Angeles, Orange, Riverside.
Pacific Cement & Aggregates, Div. of Lone Star Cement Corp.	400 Alabama St. San Francisco, Calif. 94110	do	Alameda, Fresno, Monterey, Sacramento, San Joaquin, San Mateo, Santa Cruz, Tulare, Yolo.
A. J. Riash Paving Co	99 Pullman Way San Jose, Calif. 95111	do	Santa Clara.
San Diego Consolidated Co.	P.O. Box 3093 San Diego, Calif. 92103	do	San Diego.
Teichert	P.O. Box 15002 Sacramento, Calif. 95813	do	Nevada, Sacramento, San Joaquin, Yolo, Yuba.
Triangle Rock Products, Inc.	P.O. Box 2083 San Bernardino, Calif. 92406	do	Los Angeles and San Bernardino.
Silver:			
Mexicanus Colorado, Inc., Darwin mines.	Box 206 Darwin, Calif. 93522	Underground mine.	Inyo.
Santa Rosa Mining Association.	Lone Pine, Calif. 93545	do	Do.
Union Carbide Corp., Mining & Metals Div.	270 Park Ave., 38th Floor New York, N.Y. 10017	do	Do.
Sodium compounds:			
Kerr-McGee Chemical Corp	OMB-508, Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Dry lake brines.	San Bernardino.
Stauffer Chemical Co	Box 3050, Rincon Ave. San Francisco, Calif. 94108	do	Do.
U.S. Borax & Chemical Corp.	P.O. Box 75128, Sanford Station Los Angeles, Calif. 90005	Open pit mine	Kern.

Table 24.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone:			
American Cement Corp	P.O. Box 832 Riverside, Calif. 92501	Open quarry and underground mine.	Los Angeles, Riverside, San Bernardino.
Basalt Rock Co., Inc	P.O. Box 2540 Napa, Calif. 94558	Open quarry	Marin, Napa, Sonoma.
Calaveras Cement Div., The Flintkote Co.	San Andreas, Calif. 95249	do	Calaveras and Shasta.
California Portland Cement Co.	612 South Flower St. Los Angeles, Calif. 90017	do	Kern and San Bernardino.
East Bay Excavating Co	28814 Mission Blvd. Hayward, Calif. 94544	do	Do.
Granite Rock Co	P.O. Box 151 Watsonville, Calif. 95076	do	San Benito.
Kaiser Cement & Gypsum Corp.	Permanente Rd. Permanente, Calif. 95014	do	San Bernardino and Santa Clara.
Kaiser Industries Corp	300 Lakeside Dr. Oakland, Calif. 94612	do	Contra Costa.
International Pipe & Ceramics Corp.	2901 Los Feliz Blvd. Los Angeles, Calif. 90039	Stockpile	Inyo, San Bernardino.
Lone Star Industries, Inc	400 Alabama St. San Francisco, Calif. 94110	Open quarry	Contra Costa, San Mateo, Santa Cruz.
Southwestern Portland Cement Co.	1034 Wilshire Blvd. Los Angeles, Calif. 90017	do	San Bernardino.
Talc, pyrophylite, soapstone:			
Cyprus Mines Corp	P.O. Box 1201 Trenton, N.J. 08606	Open pit and underground mines.	Inyo and San Bernardino.
L. Grantham Corp	1915 South Coast Hwy. Laguna Beach, Calif. 92651	Underground mine.	Inyo.
Minerals, Pigments & Metals Div., Pfizer Inc.	P.O. Drawer AD Victorville, Calif. 92394	Open pit and underground mines.	Inyo and San Bernardino.
Pomona Tile Manufacturing Co.	216 South Reservoir St. Pomona, Calif. 91766	Underground mine.	San Bernardino.
Western Talc Co	Box 368 Yermo, Calif. 92398	Open pit and underground mine.	Do.
Tungsten:			
Mines Exploration, Inc	P.O. Box 27 Red Mountain, Calif. 92374	Underground mine.	Do.
Union Carbide Corp., Mining & Metals Div.	270 Park Ave., 38th Floor New York, N.Y. 10017	do	Inyo.
Zinc: Darwin Mines Mexicanus Colorado, Inc.	Box 206 Darwin, Calif. 93522	do	Do.

The Mineral Industry of Colorado

By Andrew Kuklis[1]

Mineral output in Colorado for 1972 was valued at $426 million, 8% more than in 1971. Most notable was a $22 million increase in the value of mineral fuels, principally coal, natural gas, and petroleum. Increases in the values of gold, lead, molybdenum, silver, and zinc more than offset losses in iron ore, tin, tungsten, uranium, and vanadium.

The State ranked first in the nation in output of molybdenum and tin, and was second in fluorspar, tungsten, and vanadium.

Thirty-two mineral commodities, one less than in 1971, were produced in 1972. Of these, 14 were classed as nonmetals, 12 as metals, and 6 as fuels. The metals comprised 40% of the total mineral value, fuels 40%, and nonmetals 20%. Based on value, the leading commodity in each group was molybdenum, petroleum, and cement, respectively.

Within the metal group, five of the commodities increased in value and seven declined compared with 1971 figures. All mineral fuels showed increases. Nine of the nonmetals had increased in value and six had losses.

Nineteen of the 32 commodities produced had output valued at over $1 million; 9 had values exceeding $10 million.

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[1] Mining engineer, Bureau of Mines, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Colorado[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays thousand short tons	625	$1,334	747	$1,538
Coal (bituminous) do	5,337	33,813	5,522	35,687
Copper (recoverable content of ores, etc.) short tons	3,938	4,096	3,944	4,039
Feldspar do	[r] 571	4	W	W
Gem stones	NA	125	NA	131
Gold (recoverable content of ores, etc.) troy ounces	42,031	1,784	61,000	3,580
Lead (recoverable content of ores, etc.) short tons	25,746	7,106	31,346	9,423
Lime thousand short tons	193	3,039	187	4,070
Mica, sheet thousand pounds	8,300	4	14,280	7
Natural gas million cubic feet	108,537	16,932	116,949	19,297
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	929	2,462	1,245	3,349
LP gases do	1,653	3,190	1,749	3,673
Peat thousand short tons	28	156	39	210
Petroleum (crude) thousand 42-gallon barrels	27,391	92,855	32,015	109,171
Pumice thousand short tons	62	W	59	W
Sand and gravel do	27,000	30,155	28,318	34,631
Silver (recoverable content of ores, etc.) thousand troy ounces	3,390	5,241	3,664	6,174
Stone thousand short tons	3,785	7,933	4,507	9,599
Uranium (recoverable content U_3O_8) thousand pounds	2,536	15,725	1,877	11,825
Zinc (recoverable content of ores, etc.) short tons	61,181	19,700	63,801	22,649
Value of items that cannot be disclosed: Beryllium concentrate, carbon dioxide, cement, fluorspar, gypsum, iron ore, mica (scrap) (1971), molybdenum, perlite, pyrites, salt, tin, tungsten concentrate vanadium, and values indicated by the symbol W	XX	147,117	XX	146,843
Total	XX	392,721	XX	425,841
Total 1967 constant dollars	XX	333,931	XX	[p] 354,257

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Colorado, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	$8,986	$17,705	Petroleum, sand and gravel, natural gas, lime, gold, stone, silver.
Alamosa	W	112	Sand and gravel, peat.
Araphoe	14,178	15,429	Petroleum, sand and gravel, natural gas liquids, natural gas.
Archuleta	W	W	Petroleum, sand and gravel, natural gas, stone.
Baca	1,238	1,088	Natural gas, petroleum, sand and gravel, stone.
Bent	27	162	Sand and gravel, petroleum, natural gas, clays.
Boulder	14,739	15,972	Cement, sand and gravel, stone, fluorspar, lime, clays, peat, gold, lead, petroleum, tungsten, silver, copper.
Chaffee	W	W	Stone, sand and gravel, peat.
Cheyenne	1,380	W	Petroleum, sand and gravel, natural gas, stone.
Clear Creek	W	W	Molybdenum, sand and gravel, stone.
Conejos	W	102	Gold, silver, sand and gravel, copper, zinc.
Costilla	W	W	Pumice, sand and gravel.
Crowley	67	W	Sand and gravel.
Custer	78	W	Perlite, sand and gravel, stone.
Delta	4,962	1,587	Coal, sand and gravel, lime, stone.
Denver	220	736	Sand and gravel, stone.
Dolores	681	945	Petroleum, copper, silver, natural gas, lead, stone, zinc, gold.
Douglas	2,094	W	Clays, sand and gravel, stone.
Eagle	11,918	W	Zinc, lead, sand and gravel, silver, gold, copper, stone, pumice.
Elbert	374	706	Petroleum, clays, natural gas, sand and gravel.
El Paso	4,076	3,117	Sand and gravel, stone, clays.
Fremont	14,933	15,353	Cement, stone, coal, gypsum, sand and gravel, clays, petroleum, uranium, feldspar, beryllium.
Garfield	2,779	2,675	Vanadium, sand and gravel, uranium, natural gas, coal, stone.
Gilpin	20	W	Peat, gold, stone, sand and gravel, silver, zinc, copper, lead.
Grand	W	90	Sand and gravel, stone.
Gunnison	7,166	7,049	Coal, sand and gravel, lead, silver, stone, zinc, copper, gold.
Hinsdale	W	2	Stone.
Huerfano	W	W	Coal, sand and gravel.
Jackson	W	5,529	Fluorspar, petroleum, natural gas, sand and gravel.
Jefferson	9,785	12,258	Uranium, sand and gravel, stone, clays, gold, silver.
Kiowa	4,546	W	Petroleum, natural gas, sand and gravel.
Kit Carson	W	258	Sand and gravel, petroleum, stone.
Lake	87,174	93,275	Molybdenum, zinc, tungsten, lead, silver, gold, sand and gravel, tin, copper, pyrites.
La Plata	7,103	7,335	Natural gas, natural gas liquids, sand and gravel.
Larimer	9,996	13,996	Cement, sand and gravel, stone, petroleum, lime, gypsum, mica, natural gas.
Las Animas	5,410	W	Coal, sand and gravel, clays.
Lincoln	40	W	Sand and gravel, stone.
Logan	6,958	6,168	Petroleum, natural gas, natural gas liquids, sand and gravel, lime.
Mesa	5,907	3,965	Sand and gravel, uranium, vanadium, natural gas, natural gas liquids, coal, stone.
Mineral	W	4,953	Silver, lead, zinc, copper, gold, stone.
Moffat	9,190	8,847	Natural gas, petroleum, coal, sand and gravel, stone, copper, silver.
Montezuma	1,372	1,021	Petroleum, sand and gravel, natural gas, carbon dioxide, stone.
Montrose	12,022	6,805	Vanadium, uranium, coal, sand and gravel, salt.
Morgan	4,325	4,274	Petroleum, natural gas liquids, natural gas, lime, sand and gravel.
Otero	W	W	Lime, sand and gravel, stone.
Ouray	W	5,239	Zinc, lead, copper, silver, gold, sand and gravel.
Park	118	W	Peat, sand and gravel, gold, stone.
Phillips	--	W	Sand and gravel.
Pitkin	W	5,126	Coal, iron ore, sand and gravel, natural gas.
Prowers	W	W	Sand and gravel, petroleum, stone.
Pueblo	3,189	4,181	Lime, sand and gravel, clays, stone.
Rio Blanco	46,843	59,095	Petroleum, natural gas, natural gas liquids, coal, sand and gravel.
Rio Grande	W	217	Copper, sand and gravel, gold, silver.
Routt	7,335	9,360	Coal, petroleum, sand and gravel, pumice, natural gas.
Saguache	54	6	Sand and gravel, stone.
San Juan	4,890	W	Zinc, gold, lead, copper, silver.
San Miguel	20,096	19,297	Vanadium, zinc, uranium, lead, copper, gold, silver, natural gas, sand and gravel, petroleum, stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Colorado, by county—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Sedgwick	W	W	Lime, natural gas, sand and gravel, stone.
Summit	W	W	Sand and gravel, zinc, stone, lead, gold, silver, copper.
Teller	$248	W	Peat, stone, sand and gravel.
Washington	12,013	W	Petroleum, natural gas, sand and gravel.
Weld	6,817	$10,390	Petroleum, coal, sand and gravel, natural gas, lime, stone.
Yuma	W	W	Sand and gravel, natural gas.
Undistributed [1]	37,423	61,410	
Total [2]	392,724	425,841	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes gem stones, carbon dioxide, some stone and sand and gravel that cannot be assigned to specific counties, and values indicated by the symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Colorado business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ______ thousands	950.7	986.5	+3.8
Employment ______ do	919.1	955.2	+3.9
Unemployment ______ do	31.6	31.3	−0.9
Nonagricultural employment:			
Wholesale and retail trade ______ do	180.0	NA	--
Finance, insurance, and real estate ______ do	41.4	NA	--
Mining ______ do	13.4	NA	--
Construction ______ do	45.0	NA	--
Government ______ do	187.0	NA	--
Services ______ do	134.7	NA	--
Transportation and public utilities ______ do	52.5	NA	--
Personal income:			
Total ______ millions	$9,457	$10,485	+10.9
Per capita	4,153	$4,449	+7.1
Construction activity:			
New housing units authorized	52,816	64,279	+21.7
Value of nonresidential construction ______ millions	$219.4	$277.0	+26.3
Highway construction contracts awarded ______ do	$69.7	[e] $60.2	−0.7
Cement shipments to and within Colorado thousand short tons	1,274	1,470	+15.4
Farm marketing receipts ______ millions	$1,489.8	$1,770.7	+18.9
Mineral production value ______ do	$392.7	$425.8	+8.4

[e] Estimate. [p] Preliminary. NA Not available.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Employment and Injuries.—Final 1971 statistics and preliminary data for 1972 on employment and injuries in the mineral industries of Colorado, excluding the petroleum industry, are shown in table 4.

Legislation and Government Programs.—Governor John Love signed a $5 million Federal-State funding contract for "remedial action" to solve the problems that resulted from construction of homes on uranium mine tailings in Grand Junction, Mesa County. It was estimated that some 2,000 units may have gamma ray radiation and radon gas exceeding safe guideline levels established by the Office of the U.S. Surgeon General. The remedial work may comprise removal of tailings, use of sealents, improved ventilation systems, and use of shielding materials.

A joint industry-government-financed investigation of the environmental impact from oil shale development in Colorado was underway at yearend. The project, costing some $715,000, was being financed by Federal, State, and county governments and private industry, and will include a study of water resource management, regional development, land use planning, revegetation, and surface rehabilitation. The investigation of a resource prior to development was

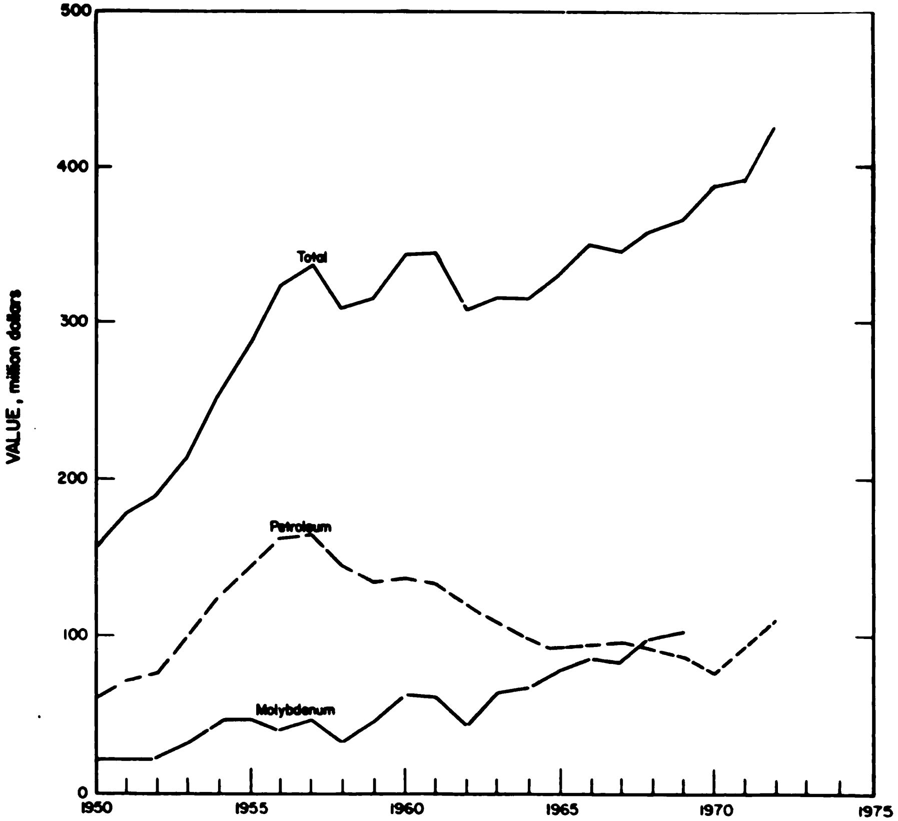

Figure 1.—Value of molybdenum, petroleum, and total value of mineral production in Colorado.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	1,290	242	312	2,465	1	145	59.23	NA
Metal	4,298	260	1,116	8,926	3	411	46.38	4,603
Nonmetal	550	212	116	928	--	18	19.39	867
Sand and gravel	1,567	204	320	2,675	1	63	23.92	2,764
Stone	736	234	172	1,400	--	28	20.00	1,505
Total[1]	8,441	241	2,037	16,395	5	665	40.87	NA
1972:[2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	3,465	280	969	7,690	5	314	41.48	4,993
Nonmetal	470	213	101	807	--	10	12.39	315
Sand and gravel	900	194	174	1,477	--	32	21.67	437
Stone	485	271	131	1,066	--	17	15.95	517
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

the first of its kind between industry and government.

The Department of Mineral Economics, Colorado School of Mines, was studying the impact of the mineral industries on the economy of Colorado. A research grant totaling $45,000 was authorized for the investigation by the Bureau of Mines, U.S. Department of the Interior. The study will determine the value of minerals and mineral-related products, and the nature of the employment levels in the industry.

Colorado School of Mines was awarded a $78,000 grant from the U. S. Department of the Interior to investigate the feasibility of removing oxides of sulfur from high-sulfur coal to permit its use as fuel in thermo-electric power generating plants. Approximately 90% of the sulfur in coals tested was removed by mixing crushed coal with an organic solvent. The resultant solution was heated in an autoclave at a temperature of 750° F and pressure of 1,000 psi.

The Department of the Interior tentatively chose 2 tracts in western Colorado for consideration in the proposed oil shale leasing program. Selection of the tracts was based on evaluation of such factors as the potential for progressive stimulation of technology, resources availability, potential recoverable resource, interest in the area, and a recognition that environmental impacts must be minimized.

The Atomic Energy Commission (AEC) released uranium-vanadium reserve tracts in the Uravan mineral belt, Colorado, for leasing purposes. Detailed information on the tracts was available from an AEC office in the area. Most tracts have been extensively drilled and developed, hence quantity of ore in place was known. The tracts, available for lease, are generally located in Mesa, Montrose, and San Miguel Counties.

The Colorado State Board of Land Commissioners issued a lease for geothermal energy on State-owned land, the first of its kind in Colorado. The lease, covering about 7,000 acres, was located between Buena Vista and Mt. Princeton in Chaffee County.

REVIEW BY MINERAL COMMODITIES

METALS

Beryllium.—The State's shipments of beryllium concentrate decreased for the fifth consecutive year. Colorado was one of three States in the nation that shipped beryllium. The other States, Utah and South Dakota, had more shipments than Colorado.

Cadmium, Indium, and Thallium.—American Smelting & Refining Co. (Asarco) recovered cadmium, indium, and thallium metal and thallous sulfate at its Globe plant in Denver from flue dust, dross, and other byproduct material from out-of-State smelters and processing plants. The value of these products was not included in the State's mineral value because of their out-of-State origin.

Copper.—Output of copper increased slightly in quantity but decreased in value compared with 1971 figures. The loss in value was due to a lower weighted average price per pound. The U. S. producer price was 50.5 cents at the beginning of 1972, climbed to a peak of 52.5 cents in February, then dropped back 50.5 cents in July, where it remained for the balance of the year. The weighted average price of a pound of copper was 51.2 cents in 1972.

Of the 17 mines with copper production, the Idarado mine of Idarado Mining Co. in Ouray and San Miguel Counties accounted for over 60% of the State copper output. The Sunnyside mine of Standard Metals Corp. in San Juan County had the second largest output. Production at the third largest source, the Camp Bird mine of Federal Resources Corp., rose significantly over that of 1971.

Fourteen counties had copper production, with San Miguel County accounting for over 51% of the State output. Other counties that had production exceeding 100 tons were, in order of output, Ouray, San Juan, Dolores, Lake, Mineral, and Rio Grande.

Colorado's only primary copper mine, the Summitville operation in Rio Grande County, was closed at yearend. Officials of Summitville Joint Ventures, Inc., operator of the mine, reported that declining ore reserves caused its shutdown.

Gold.—Gold production rose 19,069 ounces above the 1971 output of 42,031 ounces. Value for the year more than doubled because of a substantial increase in the price of gold. The weighted average price was $58.60 compared with $41.25 in 1971. Most of the gold was recovered as a byproduct from base-metal ores.

Fourteen lode and 11 placer operations yielded gold, compared with 20 and 6, respectively, in 1971. Of the placer operations, accounting for 3% (1,345 ounces) of the State output, only four were primarily for gold; the remainder were sand and gravel pits. Seven lode mines and four placer mines recovered more than 100 ounces of gold. A few ounces of gold were obtained from mill tailings and smelter cleanup.

The Sunnyside mine of Standard Metals Corp. accounted for over 40% of the State output. Other principal gold production was from the Idarado mine of Idarado Mining Co., the Leadville mine of Asarco, and the Mammoth Revenue mine of Coronado Silver Corp., all lode mines. Kerkling and Slensker Inc., with four placer mines, ranked fifth in gold output.

Among the 15 counties with gold output during 1972, San Juan, San Miguel, Lake, and Ouray were the leading sources; their production accounted for nearly 95% of the State output.

Robert Fine Partners was conducting exploratory drilling on patented claims mined for gold at the Eureka Saturday Night mine near Independence Pass. Drilling of five holes was underway at yearend, and sample cuttings from the first hole reportedly assayed 2 to 72 ounces of gold.

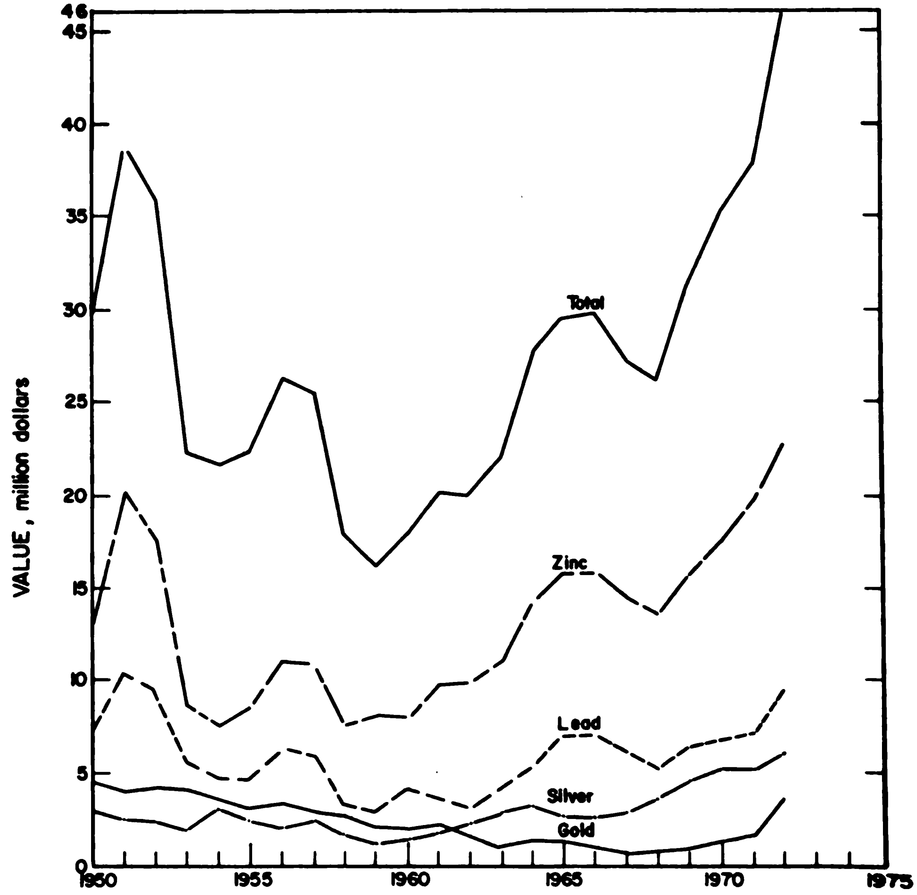

Figure 2.—Value of mine production of gold, lead, silver, and zinc, and total value of these minerals (including copper) in Colorado.

Table 5.—Colorado: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing[1]		Material sold or treated[2] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1970, Total	28	2	1,138,220	37,114	$1,350,579	2,933,363	$5,194,458
1971, Total	20	1	1,239,271	42,031	1,733,783	3,389,748	5,240,549
1972:							
Adams	--	--	--	644	37,738	83	140
Eagle	1	--	249,098	600	35,160	119,313	201,042
Gilpin	1	2	465	84	4,922	1,108	1,867
Jefferson	--	--	--	534	31,293	81	137
Ouray	1	--	156,528	3,430	200,998	173,004	291,512
Park	--	1	465	84	4,922	1,108	1,867
Rio Grande	1	--	3,730	205	12,013	3,265	5,502
San Miguel	1	--	327,791	18,427	1,079,823	495,675	835,213
Undistributed[3]	9	1	539,183	37,100	2,174,060	2,871,308	4,838,145
Total	14	4	1,276,795	61,100	3,580,461	3,663,832	6,173,558

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1970, Total	3,749	$4,326,067	21,855	$6,827,177	56,694	$17,370,019	$35,068,300
1971, Total	3,938	4,096,352	25,746	7,105,812	61,181	19,700,525	37,877,021
1972:							
Adams	--	--	--	--	--	--	37,878
Eagle	23	23,809	3,184	956,984	25,456	9,036,954	10,253,949
Gilpin	1	1,165	4	1,147	7	2,442	11,543
Jefferson	--	--	--	--	--	--	31,430
Ouray	878	898,744	5,118	1,538,357	6,462	2,293,865	5,223,476
Park	--	--	--	--	--	--	4,454
Rio Grande	101	104,276	--	--	--	--	121,791
San Miguel	2,024	938,066	15,051	4,524,397	22,206	7,882,884	20,357,552
Undistributed[3]	915	4,038,968	31,346	9,422,556	63,801	22,649,280	45,864,824
Total[4]	3,944	4,038,969	31,346	9,422,556	63,801	22,649,280	45,864,824

[1] Operations from which gold, silver, copper, lead, or zinc were recovered as byproducts from fluorspar, sand and gravel, or cleanup, not counted as mines.

[2] Does not include gravel washed.

[3] Includes Boulder, Conejos, Dolores, Gunnison, Lake, Mineral, Moffat, San Juan, and Summit Counties, combined to avoid disclosing individual company confidential data.

[4] Data may not add to totals shown because of independent rounding.

Golden Cycle Corp. was spending $6 million over a 3-year period to rehabilitate gold mining operations in the Cripple Creek area. The facilities had not produced gold since the early 1960's. As part of the project, the 6.5-mile Carlton tunnel, the shaft in the Ajax mine, and the Carlton milling facility were expected to be reactivated. The Carlton tunnel was reported in good condition and the Ajax mine shaft required minor repairs. The economic potential of about 5 million tons of mine tailings in the Cripple Creek District was evaluated for recovery of gold and silver values. In addition, surface and underground exploration will be conducted on 3,000 acres of mining claims.

Iron Ore.—For the third consecutive year, production of iron ore declined at Colorado's only producing operation, the Cooper Basin mine of Pitkin Iron Corp. in Pitkin County. The ore, magnetite with 67% iron, was shipped to the Pueblo steel mill of CF&I Steel Corp.

Lead.—The quantity of recoverable lead increased 5,600 tons, 22% more than in 1971; however, value rose over 33% because of an increase of 1.2 cents per pound in the weighted average price of lead.

Lead prices fluctuated upward and downward during the year. For example, the price reached the yearly high of 15.5 cents per pound late in February, then remained at that price level until the third quarter, when it lost 1 cent and closed the year at 14.5 cents per pound.

Table 6.—Colorado: Mine production of gold, silver, copper, lead, and zinc in 1972, by class of ore or other source material, in terms of recoverable metal

Source	Number of mines	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry silver, copper, copper-lead [1]	5	123,962	986	2,213,409	313	1,918	1,389
Copper-lead-zinc	1	386,500	21,728	584,454	2,387	9,421	11,403
Lead-zinc	7	509,694	36,199	736,331	1,221	16,721	25,350
Zinc	1	249,098	600	119,313	23	3,184	25,456
Lead cleanup, lead-zinc cleanup, fluorspar [1]	--	[2] 7,541	242	10,161	(3)	103	202
Total [4]	14	1,276,795	59,755	3,663,668	3,944	31,346	63,801
Placer	[5] 4	--	1,345	164	--	--	--
Grand total [4]	18	1,276,795	61,100	3,663,832	3,944	31,346	63,801

[1] Combined to avoid disclosing individual company confidential data.

[2] Excludes tonnage of fluorspar ore.

[3] Less than ½ unit.

[4] Data may not add to totals shown because of independent rounding.

[5] Sand and gravel operations not counted as producing mines.

Table 7.—Colorado: Mine production of gold, silver, copper, lead, and zinc in 1972, by type of material processed and method of recovery, in terms of recoverable metal

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Amalgamation: Ore	3,789	1,440	--	--	--
Smelting of concentrates	55,733	3,652,740	3,938	31,257	63,599
Direct smelting of—					
Ore	--	66	6	--	--
Cleanup	233	9,422	--	89	202
Total	59,755	3,663,668	3,944	31,346	63,801
Placer	1,345	164	--	--	--
Grand total	61,100	3,663,832	3,944	31,346	63,801

There were 13 producing mines in 11 counties; 6 mines with output in excess of 500 tons were responsible for 98% of the State production.

The Idarado mine in Ouray and San Miguel Counties was the largest single source of lead with nearly 10,000 tons. Other principal mines, in order of output, were Leadville mine (Asarco), Sunnyside mine (Standard Metals Corp.), Camp Bird mine (Federal Resources Corp.), Eagle mine (New Jersey Zinc Co.), and the Bulldog Mountain mine (Homestake Mining Co.).

Six of the 11 counties with lead output had production of over 1,000 tons. Ranked according to output, the principal counties were San Miguel, Lake, San Juan, Ouray, and Eagle. Supplying 25% of the State production, San Miguel County had the most output.

The Leadville mine of Asarco completed its first full year of operation and produced 208,000 tons of ore containing lead, zinc, and silver. Underground development was completed on the No. 5 ore body, hence production was expected to reach capacity in 1973. Ore reserves at yearend totaled over 2.6 million tons averaging 15% combined lead and zinc, with 2.5 ounces of silver per ton of ore.

The Homestake Mining Co. reportedly milled over 94,000 tons of lead-silver ore during the year at the Bulldog Mountain mine. Ore reserves at yearend were estimated over 400,000 tons grading 2.8% lead and 24.1 ounces of silver per ton. Mine development at the lower level encountered a large volume of water, which required installation of larger-than-anticipated pumps and a redesign of the underground electrical power system. As a consequence, development proceeded at a slower rate than expected, but should be completed in 1973.

The Keystone mine commenced production and shipped its first carload of lead concentrate containing copper and silver at midyear to the Asarco smelter in El Paso, Tex. Company officials stated that rising metal prices were the reason for reopening the mine. The mine, developed and operated by Asarco in the early 1950's, was closed because of depressed metal prices. Seven companies attempted to operate the mine in the past years without success. In recent years, ownership of the property was acquired by Crested Buttes Silver Mining Co., the current operator of the mine.

The Wellington Mining and Milling Co. started mining lead-zinc ores at its mine near Breckenridge. Ore was mined at a rate of 140 tons per day grading about 5% lead and 9% zinc. The company was developing a new deposit containing over 100,000 tons of lead-zinc ore; the work consisted of sinking a shaft and driving crosscuts and drifts.

Molybdenum.—Molybdenum shipments rose nearly 4% compared with those of 1971. The commodity ranked second in value of minerals produced in the State, and was exceeded by petroleum only. The two mines in Colorado, Climax in Lake County and Urad in Clear Creek County, provided over 50% of the nation's output of molybdenum and about 40% of the world's production. Both mines are owned and operated by American Metal Climax Inc. (AMAX).

Mine development continued at AMAX's Henderson molybdenum mine near Empire, Colo. The No. 2 shaft, a 28-foot-diameter unit, was bottomed out at 3,100 feet on June 14 by Harrison Western Corp., an international mine development contractor. A main ore haulage level was under construction at the 7500 level, where ore will be loaded into railroad cars for transportation by way of tunnel to the mill. Good progress was reportedly made in driving the 9.3-mile ore haulage tunnel. At yearend, construction was conducted from two directions, the underground mine and from the surface on the western slope. The $250 million mine and mill facility ultimately will produce 50 million pounds of molybdenum annually.

AMAX was developing an open pit mine on the Climax molybdenum deposit to supplement current underground production in Lake County. The $40 million investment will increase ore output to 60,000 tons per day, of which 43,000 will be from underground operations, the remainder from open pit.

Approximately 185 million tons of low-grade ore (0.28% molybdenite) was added to reserves at the Climax mine; ore that could not be economically mined by underground methods. Reserves at the Climax mine were estimated at 500 million tons having an average grade of 0.35% molybdenite. Removal of about 260 million tons of waste material would be required to develop the mine. The open pit mine will increase the flexibility of the Climax operation in meeting fluctuations in molybdenum demand.

Rare-Earth Metals.—Monazite, a combination rare-earth phosphate, was not produced in Colorado for the second consecutive year.

Silver.—Silver production increased 274,084 ounces (8%) above that of 1971; however, the value rose 18% because the weighted average price per pound of silver increased 13.9 cents. As with gold, almost all of the silver was recovered as a byproduct of base-metal ores. Six placer mines associated with sand and gravel operations recovered 164 ounces of silver, while the remaining output came from lode mines.

Of the 17 lode mines yielding silver, 5 had production exceeding 100,000 ounces and each reported an appreciable increase in output over 1971. The two principal mines, Bulldog Mountain and Idarado, were responsible for 73% of the State output.

Sixteen counties reported silver production; of which 14 produced from lode mines and two from placer operations. Leading counties in silver output, in order of production, were Mineral, San Miguel, Lake, San Juan, Ouray, and Eagle. Supplying 58% of the State output, Mineral County had the most production.

Tin.—Byproduct tin concentrate was produced at the Climax molybdenum mill of AMAX in Lake County. Tin contained in the concentrate was 31% less than in 1971. Colorado and Alaska were the only States in the nation with tin production.

A fire destroyed a tin and tungsten processing plant owned by Sweeney Milling and Mining Co. near Boulder. The facility, formerly owned by Fred H. Lenway & Co., upgraded tailings material from the Climax mill to a tin and tungsten concentrate and shipped the material to a Texas City, Tex., plant for additional refining to a marketable product. The fire destroyed the 3-story wooden structure containing the heating section and wet-processing circuit.

Tungsten.—Output of tungsten concentrate, slightly lower than in 1971, was produced as a byproduct of milling operations at the Climax molybdenum mine. The concentrate was shipped to domestic and foreign markets. The former received 85%, the latter 15%.

Uranium.—Output of uranium oxide (U_3O_8) dropped 26% in quantity compared with that of 1971. Colorado ranked fourth in the nation in production of U_3O_8 with 7% of the U. S. total production; it followed New Mexico, Wyoming, and Texas. The number of operations declined for the fourth consecutive year. Seventy operations were active in 1972 compared with 121 operations in 1971. These yielded 364,215 tons of uranium ore compared with 555,947 tons mined in 1971. Average grade of the ore was 0.28% U_3O_8; appreciably better than the average of 0.25% in 1971.

The Schwartzwalder mine operated by the Cotter Corp. in Jefferson County was the leading producer of uranium ore. Other important mines, in order of output, were the Demero Lease in San Miguel County, Rifle mine in Garfield County, Burro and Snyder mines, both in San Miguel County, and the Eula Belle mine in Montrose County, all operated by Union Carbide Corp.

Six counties had uranium production; of these, San Miguel county with 11 operations was the leading producer. Jefferson and Montrose counties ranked second and third in output, respectively; the former with only 5 operations, the latter with 39 operations.

The three uranium mills active during the year were Uravan and Rifle mills of Union Carbide Corp. and the Cannon City mill of Cotter Corp.

Homestake-Wyoming Partners, in a joint venture with Pinnacle Exploration Inc., agreed to reopen the Pitch uranium mine and conduct exploration on 11,200 acres of mineral leases in Saguache County. Pinnacle Exploration Inc. developed the Pitch mine in 1962 as an underground operation, but because of high production costs the facility was closed in 1968. A leaching process also proved uneconomical; hence other extraction methods are currently being investigated.

AMAX sold its uranium-vanadium resources in the Uravan mineral belt to Atlas Corp. The deposits, developed by Climax Uranium Inc., were reported to contain uranium and vanadium reserves ranging in value from $30 to $50 million. Atlas Corp. will develop and mine the properties during the first half of 1973 and transport ore by truck to the company's mill near Moab, Utah for processing. Company officials stated that uranium capacity of the mill will be increased and a vanadium circuit added. Also, Atlas Corp. reportedly discovered a uranium-vanadium deposit in the Uravan mineral belt of Colorado. The deposit was described as "one of the largest of its kind" by company officials.

The work schedule at the Union Carbide Corp. mill near Uravan was reduced to 3 days per week because of a decline in demand for uranium and vanadium. Depressed markets for the minerals closed over 50% of the mines in the area, especially those having less than 5 pounds of vanadium and 1 pound of uranium per ton of ore. The average ratio of ore processed at the mill is 7 pounds of vanadium to 1 pound of uranium per ton of ore. However, the company expects to continue processing and purchasing ores from independent mine operations in the Uravan district. Approximately 130 workers are employed in the mill.

At yearend, construction was started on a new vanadium recovery circuit at the Uravan mill. Its completion, scheduled for the second quarter of 1973, will allow reactivation of the finishing section at the Rifle mill.

Vanadium.—Output of vanadium dropped for the fourth consecutive year because of declining demand. Production was in the form of fused vanadium oxide (V_2O_5) recovered from processing of uranium-vanadium ore at the Rifle and Uravan mills of Union Carbide Corp.

Montrose and San Miguel Counties were the leading sources of vanadium-bearing ores; other counties with production were Mesa and Garfield.

The vanadium mine and most functions at the uranium-vanadium mill at Rifle, Colo., operated by Union Carbide Corp., were closed at midyear. An oversupply of vanadium, low prices, and declining ore reserves were the reasons for suspending most operations at the facility. Employment for 120 workers was terminated, resulting in a payroll loss of over $1 million to the area's economy.

Vanadium ore purchased from independent miners in the area will be treated in a new circuit at the Uravan mill. The rough concentrate, in liquid form, will be trucked to the Rifle mill for finish processing; then the product will be packaged and shipped to markets. Approximately 25 workers will be rehired.

Zinc.—Zinc production increased over 4% in quantity and nearly 15% in value; the higher percent increase in the latter was the result of a rise in the price of zinc in 1972. The weighted average price for zinc was 17.8 cents per pound in 1972, compared with 16.1 cents per pound in 1971.

Eleven counties had 13 operating mines. Eagle County ranked first in output, followed, in order of production, by Lake, San Miguel, San Juan, and Ouray. The five counties accounted for 97% of the State total.

Of the fourteen producing mines, six had outputs of over 500 tons. The three largest producers were the Eagle mine of New Jersey Zinc Co., the Leadville mine of Asarco, and the Idarado mine of Idarado Mining Co. Other mines with production exceeding 500 tons were the Sunnyside mine of Standard Metals Corp., the Camp Bird mine of Federal Resources Corp., and the Bulldog Mountain mine of Homestake Mining Co.

Mineral Engineering Co. leased mining properties and facilities from Emperious Mining Co. and Creede Mines Inc. comprising nearly 2,000 acres of patented claims in the Creede mining district, the 150-ton-per-day Emperious mill, and mine and plant equipment. The lessor agreed to conduct development and exploration over a 3-year period. Should the company discover sufficient ore reserves, the mine would be reopened.

Idarado Mining Co. reportedly milled 386,500 tons of lead-zinc ore in 1972, slightly less than in 1971. An accelerated underground development program resulted in adding new ore to reserves exceeding the tonnage mined during the year. Ore reserves at yearend totaled 2.9 million tons, having an average grade of 9% combined lead, zinc, and copper.

MINERAL FUELS

Carbon Dioxide.—Output of carbon dioxide from the McElmo field in Montezuma County increased 26,962 million cubic feet in 1972 and was 20% higher than in 1971.

Coal (Bituminous).—Coal production rose 185,000 tons in 1972 and was over 3% higher than in 1971. The value of output ranked third among minerals produced in the State.

Coal reproduction was reported from 35 mines, six less than in 1971. Of the mines with production, eight were strip and the remainder underground. During the year, five underground mines and one strip mine were closed. Three underground mines remained idle but shipped coal from stocks.

Eight underground mines reported production between 1,000 to 10,000 tons; eight underground mines and three strip mines between 10,000 to 100,000 tons; nine underground mines and one strip mine between 100,000 to 500,000 tons; and one underground mine and three strip mines between 500,000 to 1,000,000 tons. Three underground mines had production less than 1,000 tons.

The four largest mines, in order of production, were the Edna strip mine of Pittsburg & Midway Coal Mining Co.; Energy strip mine of Energy Coal Co.; the Allen underground mine of CF&I Steel Corp.; and Seneca strip mine of Peabody Coal Co. Coal from the Allen mine was used for steelmaking, and that from Edna, Energy, and Seneca mines for electric power generation.

Routt County, with five mines, again had the highest production with over 2.2 million tons, 40% of the State output. It also was the only county with output of more than 2 million tons. Four other counties had production of over 500,000 tons. The average price of coal produced was $6.45 per ton, up 11 cents from the 1971 average. Coal from underground mines averaged $7.75 per ton while that from strip mines averaged $4.95; comparable figures for 1971 were $7.25 and $4.50, respectively.

The coal mining industry provided employment to 1,494 workers; of these, 1,121 worked at underground mines, 158 at strip mines and the remainder in miscellaneous mine surface jobs.

Strip mines accounted for over 44% of the coal produced, with the remainder from underground mines. Nearly 85% of the underground coal was mined by continuous-mining machines.

Coal was transported to consumers by either rail or truck. The former method was responsible for 4.2 million tons, or 76% of the total coal transported.

By far, most of the coal produced was consumed in the State. Twenty-four percent was shipped to out-of-State markets. A small quantity was used at the mines.

Of the 5.5 million tons of coal produced, 1.4 million tons was captive production and 4.1 million tons was sold on the open market. Nearly all of the captive production was used for making steel in Colorado and Utah. The principal purchaser and consumer of merchant coal was the electric utility industry; most of the steam-operated plants in the State use coal for electric power generation.

Most of the coal produced was consumed as "mine run" coal. Twenty-two percent of State coal output was processed in five washing plants. A small tonnage was chemically treated or oiled.

An underground fire closed the United States Steel Corp. Somerset coal mine on May 7, 1972. The fire was probably a continuation of one that occurred during the previous month in a work out section of the mine. The company's operations provided employment to about 210 workers. The mine produced over ⅓ million tons of metallurgical coal for use at the company's steel mill in Provo, Utah. A new entrance into the mine was opened and parts of it returned to production in September.

Public Service Co. purchased about 140 gondola-type railroad cars valued at $2 million from Darby Corp. Kansas City, Kans., to transport coal from Gillette, Wyo., for use at the Comanche steam electric generation plant near Pueblo. The 100-ton-capacity cars will be employed in two trains of 64 cars each for continuous shuttle service between mine and plant, a distance of about 600 miles. A 20-year contract was negotiated with the Coal Div. of AMAX and Burlington Northern Railroad, the former to supply coal, the latter to provide motive power and track system.

Natural Gas.—Marketed natural gas increased 8% in quantity and 14% in value compared with 1971. The higher increase in value reflected a 6% increase in the average price of natural gas. Total production of natural gas, as reported by the State Oil and Gas Conservation Commission, was nearly 126.0 billion cubic feet, 8% higher than in 1971.[3] Twenty-six counties reported marketed natural gas, one more than in 1971. The three leading counties, in order of quantity, were La Plata, Rio Blanco, and Moffat.

The five largest dry-gas fields were Ignacio-Blanco (24.9 billion cubic feet), Dragon Trail (10.1 billion cubic feet), Powder Wash (7.0 billion cubic feet), Piceance

Table 8.—Colorado: Bituminous coal production, by type of mine and county in 1972
(Excludes mines producing less than 1,000 short tons annually)

County	Number of Mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total	
Delta	3	--	3	98	--	98	$1,132
Fremont	5	2	7	78	136	214	1,045
Garfield	1	--	1	5	--	5	W
Gunnison	4	--	4	719	--	719	6,894
Huerfano	1	--	1	4	--	4	W
La Plata	1	1	2	7	4	11	47
Las Animas	1	--	1	616	--	616	W
Mesa	1	--	1	11	--	11	W
Moffat	2	--	2	294	--	294	W
Montrose	--	1	1	--	93	93	546
Pitkin	3	--	3	649	--	649	3,855
Rio Blanco	1	--	1	1	--	1	W
Routt	1	4	5	12	2,219	2,231	8,998
Weld	3	--	3	575	--	575	2,972
Undistributed	--	--	--	--	--	--	10,150
Total[1]	27	8	35	3,070	2,451	5,522	35,637

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Data may not add to totals shown because of independent rounding.

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[3] Colorado Department of Natural Resources, Oil and Gas Conservation Commission. Oil and Gas Statistics 1972. Production review, p. 23. All natural gas and petroleum production data cited in the text of this chapter are from this publication.

Creek (6.8 billion cubic feet), Hiawatha West (6.7 billion cubic feet).

The Rangely-Weber reservoir, Rio Blanco county, produced the largest quantity of wet gas, 1.7 billion cubic feet. All the output was processed for removal of liquids; none was returned to the reservoir. The Wilson Creek reservoir produced 2.0 billion cubic feet of wet gas; 403 million cubic feet was returned to the field.

The American Gas Association, Inc. (AGA), and the American Petroleum Institute (API), estimated yearend natural gas reserves in the State at 1.7 trillion cubic feet.[3] Extensions of existing fields added 94.2 billion cubic feet of natural gas and new fields and pools added 46.4 billion cubic feet to the available reserves.

The State's six gas storage reservoirs, Ashbury Creek, Fort Morgan, Fruita, House Creek, Leyden Mine, and Springdale, had 18.7 billion cubic feet of natural gas in storage at the beginning of 1972. During the year, 8.3 billion cubic feet was injected, and 8.8 billion was withdrawn for a yearend balance of 18.2 billion cubic feet. As in past years, the Fort Morgan reservoir, Morgan County, was the most active, with 4.7 billion cubic feet injected and 5.9 billion cubic feet withdrawn. The second most active was the Leyden reservoir in Jefferson County, a converted coal mine, with 2.4 billion cubic feet injected and 2.5 billion cubic feet withdrawn.

Natural Gas Liquids.—Production of natural gas liquids increased 13%. LP gases increased 3% and natural gasoline 25% in quantity compared with 1971.

Natural gas throughput of the 17 gasoline plants, according to the Oil and Gas Conservation Commission, was 114.9 billion cubic feet for the year; output was 3.1 million barrels of product.[4]

Oil Shale.—Anvil Point, the Bureau of Mines oil shale pilot plant and mine, was leased to Development Engineering Inc. (DEI) for 5 years. DEI will spend $5 million to test a new kiln retort process and experiment with spent shale. Also, some research will be conducted on the feasibility of extracting associated minerals of nahcolite and dawsonite. The company plans to utilize ore from the Mahogany Ledge, which contains crude oil ranging from 34 to 36 gallons per ton for feed material in the kiln. The project will generate employment to over 50 workers.

The Colony Development Corp. experimental oil shale plant on Parachute Creek was closed at midyear. The company completed its basic testing of retorting pro-

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[3] American Gas Association, Inc., American Petroleum Institute, and Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids, Natural Gas in the United States and Canada and United States Productive Capacity as of Dec. 31, 1972. V. 27, May 1973, pp. 22, 23, 115, 116, and 117.

[4] Reference cited in footnote 2, pp. 124–128.

Table 9.—Colorado: Gas input and products at natural gas liquids extraction plants in 1972

Plant	County	Owner	Gas input (million cubic feet)	Products (thousand barrels)
Adena	Morgan	Union Oil Co. of Calif	3,262	355
Bennett	Adams	Halliburton Resource Mgt	122	7
Bombing Range	Arapahoe	Canon & Gilmore	8	(1)
Comanche Creek	Elbert	do	622	30
Dragon Trail	Rio Blanco	Sun Oil Co	5,274	176
Dragoon	Arapahoe	Dragoon Gas Co	253	4
Fruita	Mesa	Continental Oil Co	5,780	130
McClave	Kiowa	Fleetwood Drilling Co	1,817	53
Peoria	Arapahoe	Amoco Production Co	4,081	460
Piceance Creek	Rio Blanco	Chadbourne Corp	8,559	104
Rangely	do	Chevron Oil Co	1,794	--
San Juan	La Plata	El Paso Natural Gas Co	77,220	1,248
Third Creek	Adams	Koch Oil Co	1,070	38
Vallery	Morgan	Vallery Corp	748	69
Wattenburg	Weld	Production Operators, Inc	1,522	7
Wilson Creek	Rio Blanco	Texaco, Inc	1,129	204
Yenter	Logan	Excelsior Oil Corp	1,635	167
Total[2]			114,898	3,051

[1] Less than ½ unit.

[2] Data may not add to totals shown because of independent rounding.

Source: Colorado Department of Natural Resources, Oil and Gas Conservation Commission. Oil and Gas Statistics 1972, Plant Intake and Products, pp. 124–128.

cesses and mining methods. Data obtained were being evaluated to determine the economic feasibility of developing a commercial oil shale processing facility. About $24 million was authorized for the expenditures on researching oil shale development. The experimental operation resulted in mining and processing of nearly 1 million tons of oil shale from the Mahogany Ledge. The plant, processing 34 to 36 gallons per ton of oil shale material, produced at a rate of 800 barrels of oil per day during the experimental operations. Colony Development Corp. is a joint venture of Atlantic Richfield Co., Sohio Petroleum Co., Oil Shale Corp., and Cleveland-Cliffs Iron Co.

Peat.—Production of peat rose significantly over that produced in 1971. Ten operations were located in six counties; four were in Teller; two in Gilpin; and one each were in Alamosa, Boulder, and Park Counties.

Park County was the leading source with 18,500 tons, followed by Teller with 14,500 tons. The two counties accounted for 86% of the State output.

The average value of $5.38 per ton for peat was $0.19 per ton less than in 1971 and $0.62 below the value for 1970.

Almost one-half of the output, 34,777 tons, was shipped in bulk, the rest was packaged. Of the total, 36,119 tons was not processed. Fifty-seven percent of the production, 22,128 tons, was used for general soil improvement, 15,300 tons as filter material in mixed fertilizer, and the remaining 1,100 tons for miscellaneous purposes.

Petroleum.—Output of petroleum was up 17% in quantity and 18% in value compared with 1971 figures. The higher percentage increase in value was due to an increase in wellhead price per barrel of petroleum. Petroleum continued to be the most valuable mineral produced in Colorado, comprising 26% of the State's total value.

The leading county in oil output was Rio Blanco with 15.8 million barrels, or 49% of the State total; also the county had two major oilfields, Rangely-Weber and Wilson Creek. Arapahoe and Washington Counties ranked second and third, respectively, with 6.3 million barrels and 20% of the State's output.

The Rangely-Weber reservoir continued to dominate Colorado's oil yield. With a cummulative output at yearend of 461.2 million barrels of oil, it produced 46% of the State's cummulative oil production. Output in 1972 rose 30% over that produced in 1971.

During the year 41 fluid-injection projects were operating in 35 fields; of these, 37 were waterflood projects, 3 were gas injections and one was combined gas and water-injection.

Water injected in all projects totaled 164.6 million barrels; of this, 89.9 million barrels or 55% was injected into Rangely-Weber reservoir. Again, the State data does not differentiate between "new" water produced with the oil and that which is recycled.

API and AGA[5] estimated that the State reserves of crude oil at yearend totaled 326.4 million barrels. Additions from revisions and extensions amounted to 16.5 million barrels.

An additional 94.3 million barrels were considered economically available by fluid injection. New fields and pools added 9.4 million barrels to the reserves.

The State's three operating refineries remained the same as in 1971, Continental Oil Co. and the Refinery Corp. at Denver, and American Gilsonite Co. at Fruita. Total refining capacity for the State was 51,450 barrels of crude oil per calendar day, an increase of over 7% from that of the previous year. The refinery at Grand Junction owned by Morrison Refining Co. remained closed.

The refineries processed 14.4 million barrels of petroleum; of this 11.5 million barrels was from other States. Wyoming continued as the principal out of State supplier with 10.2 million barrels. Also supplying petroleum to Colorado were Montana and Utah. State producers shipped 25.7 million barrels of petroleum out of State, or 80% of Colorado's output. Utah, with Salt Lake City as a refinery and marketing center, received 15.7 million barrels, chiefly from the Rangely-Weber and other northwestern Colorado oilfields. Other recipients, in order of quantity, were Illinois (4.3 million barrels), Kansas (3.3 million barrels), and Indiana (1.3 million barrels). A small quantity was shipped to Oklahoma and Wyoming.

Continental Oil Co. authorized expenditure of $6 million for expansion of its oil refinery at Denver. A fluid catalytic cracking unit, gas recovery system, and other major equipment will be added and will increase output of petroleum products by about 50% at the refinery. Completion of the expansion project was scheduled for the spring of 1973.

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[5] Reference cited in footnote 3, pp. 22-23.

Table 10.—Colorado: Crude petroleum and natural gas production, by county

County	Number of producing wells [1]	Oil [2] (thousand barrels)	Gas (million cubic feet)
Adams	155	2,775	6,818
Arapahoe	107	3,249	4,774
Archuleta	27	56	19
Baca	69	51	3,925
Bent	1	14	34
Boulder	2	1	--
Cheyenne	35	485	14
Dolores	8	139	368
Elbert	10	144	597
Fremont	28	21	--
Garfield	20	--	1,139
Jackson	47	347	6,092
Kiowa	63	1,067	1,826
Kit Carson	2	4	--
La Plata	501	26	25,310
Larimer	41	119	35
Logan	256	1,461	2,804
Mesa	34	--	2,335
Moffat	168	910	23,461
Montezuma	32	222	649
Morgan	124	644	3,241
Pitkin	5	--	644
Prowers	1	4	--
Rio Blanco	553	15,775	23,705
Routt	9	67	--
San Miguel	8	25	3,198
Sedgwick	3	--	315
Washington	321	3,031	1,185
Weld	196	1,378	4,451
Yuma	5	--	10
Total	2,831	32,015	116,949

[1] Number of wells reported as producing during December 1972.

[2] Condensate production is included as Oil production.

Source: Colorado Department of Natural Resources, Oil and Gas Conservation Commission. Oil and Gas Statistics 1972, Production by Leases, pp. 12–86.

Table 11.—Colorado: Oil and gas well drilling completions in 1972, by county

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Adams	54	13	33	19	5	58	182	1,352,654
Arapahoe	19	4	7	9	2	36	77	579,161
Archuleta	1	--	--	--	--	1	2	6,950
Baca	--	4	5	--	2	1	12	49,660
Bent	--	--	2	2	--	1	5	25,016
Cheyenne	6	--	4	1	--	7	18	99,315
Crowley	--	--	--	--	--	2	2	4,938
Delta	--	--	--	--	--	2	2	8,848
Dolores	1	1	--	--	--	1	3	19,001
Elbert	4	--	1	--	--	9	14	108,018
El Paso	--	--	--	--	--	3	3	18,524
Garfield	--	3	--	--	1	1	5	19,527
Grand	--	--	--	--	--	1	1	5,900
Gunnison	--	--	--	--	--	1	1	8,450
Huerfano	--	--	--	--	--	4	4	8,620
Jackson	19	2	11	5	--	5	42	86,773
Kiowa	9	1	11	--	--	9	30	141,657
La Plata	--	2	1	--	2	1	6	43,190
Larimer	--	--	--	--	--	1	1	1,949
Las Animas	--	--	--	--	--	1	1	1,628
Lincoln	--	--	--	--	--	15	15	60,087
Logan	4	2	15	3	3	43	70	363,140
Mesa	--	1	--	--	--	3	4	13,763
Moffat	1	10	4	2	1	8	26	162,350
Montezuma	--	--	1	--	--	3	4	14,533
Morgan	3	1	16	1	4	26	51	291,066
Otero	--	--	--	--	--	1	1	6,550
Phillips	--	--	--	--	--	4	4	15,454
Pitkin	--	--	1	--	--	--	1	5,104
Prowers	--	1	--	--	--	3	4	22,802
Pueblo	--	--	--	--	--	1	1	2,520
Rio Blanco	36	17	24	--	2	10	89	395,759
Routt	--	--	--	--	--	2	2	8,994
Sedgwick	--	--	--	--	--	4	4	15,464
Washington	15	1	21	2	2	79	120	563,960
Weld	57	27	12	27	5	59	187	1,166,898
Yuma	--	5	--	--	--	6	11	29,786
Total	229	95	169	71	29	412	1,005	5,728,009

Source: American Petroleum Institute.

Table 12.—Colorado: Principal oil and gas discoveries in 1972

County and field	Well	Operator	Location			Producing formation	Initial production		Remarks
			Section	Township	Range		Barrels of oil per day	Thousand cubic feet of gas per day	
Adams:									
Holster	State of Colorado	Amoco Production Co	16	2S	66W	J sandstone	320	3,439	Flowing.
Irondale	Haugen	Tiger Oil Co	30	2S	61W	D sandstone	369	--	Pumping.
Longbranch	Vetter	do	22	2S	62W	J sandstone	--	3,500	Flowing.
Manila	Ruth	Marlis Production Co	21	3S	64W	do	155	1,000	Do.
Musket	Jolly-Axtel	Ferris & Kimbark Operating Co	25	3S	57W	do	40	--	Pumping.
Pyramid	Murphy	Sundance Oil Co	8	1S	60W	D sandstone	--	2,375	Flowing.
Arapahoe:									
Lowry	State	Chandler & Associates, Inc	25	5S	65W	J sandstone	566	113	Do.
Peace Pipe	Herskind	Toltek Drilling Co	2	5S	62W	do	--	7,044	Do.
Bent:									
Sniff Ranch	Government	Davis Drilling Co	11	24S	49W	Atoka	41	--	Pumping.
Purgatoire	Husky-State	Koch Exploration Co	16	23S	51W	do	70	--	Do.
Kiowa:									
Lingo	Brown	Gas Producing Enterprises	20	18S	46W	Marm	47	--	Do.
Logan:									
Buckeye	Lusch	Monarch Royalties, Inc	3	7N	55W	J sandstone	22	--	Do.
Sod Buster	Ladd	Bright & Schiff, Inc	14	6N	54W	do	44	--	Do.
Wind Song	Eaton	Sage Oil Co., Inc	5	9N	53W	D sandstone	171	--	Do.
Winston North	Roper	Rex Monahan, Inc	31	11N	52W	J sandstone	18	--	Do.
Washington:									
Chileno	Pieper	Toltek Drilling Co	28	2N	52W	D sandstone	--	7,800	Flowing.
Snowflake	Barnholt	Jim Snyder Drilling Co	36	3N	54W	J sandstone	--	4,948	Do.
Zephyr	Mefford	William D. Hewit, Inc	22	3N	54W	D sandstone	42	--	Pumping.
Weld:									
Calico	King	Exeter Drilling & Exploration Co	34	1N	61W	J sandstone	--	1,500	Flowing.
Johnstown	Henderson	Sundance Oil Co	4	4N	67W	Shan	80	--	Pumping.
Reward	2-12 State	Allison Drilling Co	12	2N	61W	D sandstone	66	--	Do.
Spindle	Suckla Farm	Amoco Production Co	33	2N	67W	Sussex	111	100	Flowing.
Thunderbird	Sooner-Federal	Jim Snyder Drilling Co	25	8N	58W	J sandstone	175	875	Do.

Source: Petroleum Information Corporation. 1972 Resume, Oil & Gas Operations in the Rocky Mountain Region.

Exploration and Development.—During 1972, for the second consecutive year, Colorado was the leading State in the Rocky Mountain Region in drilling activity. The number of wells drilled for oil and gas exploration exceeded those of other States, and in addition, Colorado supported the strongest new field development program.

A total of 1,005 wells were drilled, the highest on record, which exceeded the total of the previous record year of 1971 by 68 wells. Major increases were in field development drilling, reflecting the desire to increase production from established sources. Total wildcat drilling declined to 512 wells from 563 wells drilled in 1971. However, wildcat drilling resulted in 100 successful wells; of these, 28 were new oilfields, 23 new gasfields, 26 new pool discoveries, and 32 wells were successful wildcat outposts. The success ratio for wildcat wells drilling was 20%, a significant improvement over the 10% achieved in 1971. For development well drilling, the success ratio was 66%, the same as in 1971.

Weld County again was the leader in drilling activity with 187 completions compared with 172 in 1971. Development drilling in the Spindle oilfield accounted for more than half of the completions in the county during 1972. At yearend, the field had 60 producing wells, 52 of which were completed by Amoco Production Co. Adams county ranked second in drilling activity with 182 completions, an increase of 46 well completions over 1971. The significant increase in well completions was due to development drilling in the Nile and Hombre gasfields and Irondale and Third Creek oilfields. Washington county rose from fourth to third place in well completions with 120 wells drilled. Other counties, in order of well completions, were Rio Blanco, Arapahoe, and Logan.

The State had 28 oilfield discoveries in 1972. Based on initial potential, the most significant discovery was the Spindle oilfield in Weld County. The discovery well, Suckla Farms-B, NE1/4NE1/4, sec. 33, T2N, R67W, was completed and flowed 111 barrels of oil and 100 thousand cubic feet (Mcf) of natural gas per day from the Sussex formation of Cretaceous age. The well was drilled by Amoco Production Co.

Tiger Drilling Co. drilled the discovery well in the Irondale oilfield near Bennett in Adams County. The discovery well No. 1–30 Haugen, located in the NW1/4NW1/4, sec. 30, T2S, R61W, was completed and flowed 369 barrels of oil per day from a perforation at 7,080 to 7,104 feet in the "D" sandstone of Cretaceous age. By yearend, the field had 23 producing wells, of which one produced natural gas, the remainder oil. Initial production at the oil wells completed in the field ranged from 108 to 619 barrels of oil per day.

Allison Drilling Co. found a new oil pay in an outpost well from perforations at 5,076 to 5,096 feet in the Shannon formation in the Spindle field in Weld County. The discovery well, located in the NE1/4-SW1/4, sec 36, T2N, R68W, flowed 168 barrels of oil per day. It marked the first production from strata of Upper Cretaceous on record in Colorado.

Chandler & Associates, Inc. discovered the Lowry oilfield in Arapahoe County, 16 miles southwest of Denver. The discovery well No. 13–25 State, SW1/4SW1/4, sec. 25, T5S, R65W, was completed on June 6, 1972, and flowed 566 barrels of oil and 113 Mcf of natural gas per day from a perforation at 8,582 to 8,590 feet in the "J" sandstone of Cretaceous age. The discovery was responsible for an active development program in the area and resulted in drilling of eight oil wells and one gas well at yearend. Texaco was the operator of six wells including one completed late in the year that pumped 1,335 barrels of oil per day.

Colorado had 29 new gas discoveries in 1972. On the basis of initial potential, the most significant discovery was the Washington County Chileno gasfield drilled by Toltek Drilling Co. The discovery well No. 1 Pieper, NE1/4NE1/4, sec. 23, T2N, R52W flowed 7,800 Mcf of natural gas per day from the "D" sandstone of Cretaceous age. In Arapahoe County, the discovery well No. 1 Herskind, NW1/4NW1/4, sec. 2, T5S, R62W, was completed on October 2, 1972, and flowed 7,044 Mcf of natural gas per day from a perforation at 7,368 to 7,378 feet in the "J" sandstone of Cretaceous age.

A total of 37 new wells were drilled in the giant Wattenberg gasfield during 1972. The field was discovered by Tom Vessels in 1970. The Federal Power Commission (FPC) was studying a marketing agreement between Panhandle Eastern Pipe Line Co. and Colorado Interstate Corp., hence major development of natural gas resources in the field was delayed and depended on a decision by FPC.

NONMETALS

Cement.—Portland and masonry cement were produced and shipped by Ideal Cement Co., a division of Ideal Basic Industries, Inc., and Dewey Rocky Mountain Cement Co., a division of Martin Marietta Corp. Shipments of portland and masonry cement were 10% and 26% greater, respectively, than those of 1971. The Bureau of Mines changed its method of reporting cement shipments from barrels to short tons. Increased shipments was due to a large demand by the residential, highway, and industrial construction industries.

Ready-mix-concrete companies purchased over three-quarters of the portland cement. Other customers, in order of quantity, were concrete product manufacturers, building material dealers, and highway contractors. Over two-thirds of the portland cement production shipped from plants was by truck and the balance was by rail.

Ideal Cement Co. was spending $25 million to enlarge and modernize its Canon City cement plant. The capacity of the facility will be doubled to nearly 1 million tons of cement annually. Major cement production components that will be added include new crushing facilities, raw- and finish-grinding mills, a rotary kiln, and cement product storage silos. The construction and engineering firm of Ken R. White Co., Denver, was engaged as the contractor; completion was scheduled for early 1974.

Clays.—Production of clay increased 20% in quantity and 15% in value compared with 1971 figures. Increased output was due to a large demand for clay products by the building industry. Ratio of clay varieties to total clay sold and used were miscellaneous clay and shale, 93%; and fireclay and bentonite 7%. Clay used by producers for manufacturing clay products (captive production) amounted to about three-quarters of the total; the balance was sold as raw clay. Fire clay was used for making heavy clay products, refractories, and a bonding agent; miscellaneous clay and shale were used for building brick, lightweight aggregate, and pottery.

The number of active companies operations increased from 18 to 20 while operations decreased from 56 to 48 in 1972. Five companies produced fire clay, two bentonite, and 13 common and undifferentiated clay and shale. The largest producer, the Idealite Co., a division of Ideal Basic Industries, mined shale for making lightweight aggregate.

Other leading producers were Robinson Brick & Tile Co., G. W. Parfet Estate Inc., and Conda Wesley. Clay was produced at 48 mines in nine counties, of which 15 mines were in Jefferson Country, eight in Douglas County, seven in Fremont County, six in Pueblo County, four in Boulder County, three in Las Animas County, two each in Elbert and El Paso Counties, and one in Bent County.

Idealite, with only one mine, was the only company producing more than 200,000 tons. Nine companies had production over 20,000 tons, four between 10,000 and 20,000 tons, and the remaining seven had under 10,000 tons.

The average unit price for miscellaneous clay and shale was $1.91 per ton, that of fireclay $3.80 per ton, compared with $1.87 and $5.69 per ton, respectively for 1971.

Feldspar.—The only source of marketable feldspar in Colorado was the Mica Lode mine in Fremont County, operated

Table 13.—Colorado: Clays sold or used by producers, by county

County	1971 Short tons	1971 Value	1972 Short tons	1972 Value
Bent	98	$492	229	$1,143
Boulder	14,891	19,200	7,315	22,852
Douglas	W	W	87,990	163,046
Fremont	23,760	73,556	29,821	82,448
Jefferson	415,091	762,866	486,425	901,794
Las Animas	W	W	22,673	58,031
Pueblo	62,431	264,657	61,752	152,715
Other counties[1]	108,963	213,727	50,736	151,185
Total	625,234	1,334,498	746,941	1,533,214

W Withheld to avoid disclosing individual company confidential data; included with "Other counties."

[1] Includes Custer (1971), Elbert, El Paso, and data indicated by symbol W.

by Lockhart & Sons. Output of feldspar was considerably lower than in 1971 because of depressed markets. The product was used for decorative aggregate.

Fluorspar.—Fluorspar was produced and shipped by the Allied Chemical Corp. mine in Boulder County and by the Ozark Mahoning Co. mine in Jackson County. Shipments of fluorspar were 11% lower in quantity compared with 1971 figures. A 7% increase in the average price of fluorspar prevented a sharper drop in output. Slightly more than one half of the fluorspar was used in making hydrofluoric acid, the remainder for metallurgical purposes.

Geo-Surveys, Inc., discovered a rich fluorspar deposit on the westerly side of North Park, 18 miles west of Walden, Jackson County. The width of some veins ranges from 1 to 50 feet; only limited sampling was reportedly conducted at yearend. The company initiated an intensive exploration program and feasibility study to determine the viability of a 300-ton-per-day operation.

Gypsum.—Output of gypsum increased 16,000 tons in 1972 and was 13% more than in 1971. The increase was due to greater production at the Johns-Manville Corp. plant near Florence in Fremont County. Over 59% of gypsum production was calcined and used in the manufacture of building products, principally wallboard material. The remaining 41% of uncalcined gypsum was marketed as a soil conditioner and cement retarder, the former to farm supply stores, the latter to cement manufacturing plants.

The four companies that mine gypsum were Johns-Manville Corp., U.S. Soil Conditioning Co., J.C. Lackey Inc., and Ernest W. Monroe Inc.; of these, the first three were in Fremont County, the last in Larimer County.

Lime.—Lime ouptut, down 6,000 tons from 1971, came from the same 10 plants that operated in 1971. Nine kilns were at sugar beet facilities of the Great Western Sugar Co., American Crystal Sugar Co., and Holly Sugar Corp.; their production was used in refining sugar.

CF&I Steel Corp. produced high-quality lime for use in the company's basic oxygen steel furnaces. Steel manufactured by this process consumes up to 150 pounds of lime per ingot-ton of steel. A small quantity of hydrated lime was produced for use in soil stabilization.

Ten counties produced lime in 1972, the same as last year. Leading counties were Pueblo, Morgan, and Larimer.

Mica.—A small quantity of sheet mica was produced by the Georgetown Lumber and Timber Co. from the JBT mine near Idaho Springs, Clear Creek County. The State was the only producer of sheet mica in the nation. Output of scrap mica at the Pole Cat mine operated by Russell A. Johnson rose 72% in quantity and 78% in value compared with that of 1971.

Perlite.—Persolite Products Inc., the only producer of crude perlite in Colorado, reported a 41% decline in output from its Rosita mine in Custer County. Production was shipped to the company plant near Florence and expanded. A small quantity of crude perlite was sold to local markets.

Perlite also was expanded at two other plants in the State, Grefco, Inc. at its Antonito plant; and W.R. Grace & Co. at its Denver plant. Crude perlite consumed at these expanding plants was shipped from deposits in New Mexico. Expanded perlite was used mostly for making plaster, filter aid, loosefill insulation, and filler and fire base material, as an admixture in concrete aggregate, for soil conditioning, and in oil well cementing.

Pumice.—Value of pumice-type material output decreased over 11% compared with 1971 figures. The lower output was due to a drop in demand for the material in concrete aggregate and railroad ballast. Also, the Saguache mine of Volcanic Materials Inc. was inactive during the year.

Scoria was produced by Colorado Aggregate Co., Inc., at the Mesita Hill mine in Costilla County and by McCoy Aggregate Co. at the McCoy mine in Routt County. Volcanic Cinder was produced by Dotsero Block Co. Inc. at the Dotsero mine in Eagle County.

Pyrites.—Output of pyrites, a byproduct of molybdenum milling at Climax, decreased by about one-half of that produced in 1971. Production was sold to Allied Chemical Corp. for making sulfuric acid at its Denver plant.

Salt.—Salt in the form of brine was recovered in Montrose County by Union Carbide Corp. for use in the company's uranium-vanadium mill at Uravan. Output dropped significantly from that produced in 1971.

Sand and Gravel.—Sand and gravel production rose 5% to a record 28.3 million tons. The increase reflected the higher level of heavy construction in the State. Based on value, sand and gravel was the most important nonmetallic mineral produced in Colorado; the value, $34.6 million, accounted for 8% of the State mineral production.

Gravel production was 17.1 million tons and that of sand 5.1 million tons, representing 60% and 18% respectively, of total output of sand and gravel. The average price for gravel was $1.32 per ton and for sand $1.51 per ton.

Commercially classed operations produced 22.2 million tons of sand and gravel, 78% of the State total output. Leading producers those with production of over 500,000 tons, in order of output, were Cooley Gravel Co., Asphalt Material & Paving Co., Western Paving Construction Co., Brannan Sand & Gravel Co., and Boulder Gravel Products Inc.

Noncommercial production; that produced for Governmental agencies, either by Government crews or by contractor, accounted for 6.1 million tons, 22% of total output. The number of sand and gravel operations declined from 274 in 1971 to 258 in 1972. Of the operations, 53% were Government-and-contractor and 47% were classed as commercial.

Fountain Sand and Gravel Co., a subsidiary of CF&I Steel Corp. purchased operating assets of Mountain Paving Inc., a producer of ready-mix concrete, sand and gravel, and asphalt paving material. Mountain Paving Inc. continued operating as a division of CF&I Steel Corp. in producing rock products.

Columbine Glass Co. was doubling the capacity of its plant in Denver at a cost of $5 million. The addition of 45,000 square feet of manufacturing, inspecting and packaging space will result in increasing employment by about 60 workers. A major component of the expansion was the installation of machines to manufacture 640,000 bottles per day. Also, a new flint furnace eventually will be added that will enable the company to recycle glass bottles at a rate of 75 million annually. One of the largest markets for the company's product was the local beer industry, specifically Adolph Coors Co., Golden, the nation's fourth-largest brewer of beer.

Table 14.—Colorado: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Commercial operations:				
Sand:				
Building	2,533	3,420	3,832	5,732
Fill	344	355	292	326
Paving	277	348	882	1,351
Other uses [1]	477	900	108	317
Total [2]	3,632	5,023	5,114	7,727
Gravel:				
Building	4,270	7,076	4,849	8,199
Fill	427	407	370	352
Paving	9,375	10,515	11,096	13,026
Railroad ballast	90	129	90	105
Miscellaneous	562	677	506	581
Other uses	789	1,046	187	294
Total [2]	15,513	19,850	17,098	22,558
Government-and-contractor operations:				
Sand:				
Building	186	191	55	116
Fill	25	25	37	39
Paving	431	448	316	265
Other uses	60	14	4	2
Total [2]	702	677	412	422
Gravel:				
Building	165	228	103	193
Fill	1,700	448	1,337	425
Paving	4,738	3,853	4,224	3,306
Other uses	551	79	31	1
Total [2]	7,153	4,606	5,695	3,924
Total sand and gravel [2]	27,000	30,155	28,318	34,631

[1] Includes railroad ballast (1972), blast, engine, filtration, oil (hydrofrac), and other sands.

[2] Data may not add to totals shown because of independent rounding.

Table 15.—Colorado: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Adams	16	3,047	3,818	22	5,203	6,962
Alamosa	1	236	29	3	210	110
Arapahoe	8	1,386	2,175	8	W	W
Archuleta	3	92	103	3	46	60
Bent	1	57	22	2	W	W
Boulder	12	3,051	3,634	9	2,311	3,164
Chaffee	2	200	258	3	152	133
Cheyenne	1	29	6	1	64	59
Conejos	1	20	20	2	W	W
Costilla	4	86	158	6	274	351
Crowley	2	44	67	2	W	W
Custer	2	W	W	1	46	13
Delta	4	86	153	6	274	351
Denver	1	129	220	4	586	736
Dolores	2	W	84	--	--	--
Douglas	6	1,312	W	4	177	69
Eagle	2	W	202	6	512	718
Elbert	4	45	60	2	34	17
El Paso	18	3,010	3,037	9	1,321	1,751
Fremont	9	245	279	6	190	129
Garfield	2	127	319	3	386	464
Gilpin	--	--	--	1	2	2
Grand	4	W	W	4	55	90
Gunnison	5	W	386	2	W	W
Huerfano	3	51	W	2	W	W
Jackson	2	43	51	2	W	W
Jefferson	12	2,117	2,473	18	3,311	4,492
Kiowa	2	71	18	2	W	28
Kit Carson	2	31	W	3	241	241
Lake	2	169	210	4	80	W
La Plata	7	312	401	4	93	132
Larimer	12	1,130	1,466	15	1,926	1,949
Las Animas	3	W	117	4	W	W
Lincoln	5	136	40	4	124	W
Mesa	7	r 1,158	1,041	10	1,109	1,177
Moffat	7	477	354	5	220	87
Montezuma	10	921	332	4	738	154
Montrose	10	246	294	6	313	403
Morgan	7	209	98	5	163	112
Otero	3	W	W	3	248	169
Ouray	3	W	W	1	15	15
Park	4	52	54	3	W	W
Pitkin	5	371	514	3	W	W
Pueblo	8	1,093	1,500	7	1,340	1,877
Rio Grande	3	W	W	3	73	95
Routt	5	W	W	4	63	W
Saguache	2	107	38	1	11	6
San Juan	2	W	41	--	--	--
Sedgwick	3	381	W	3	W	W
Summit	5	W	W	6	740	907
Teller	2	W	W	1	9	8
Washington	2	494	249	1	W	5
Weld	8	250	335	8	1,186	1,616
Yuma	3	221	85	3	87	35
Undistributed[1]	r 19	r 3,844	r 5,572	19	4,631	6,268
Total	274	27,000	30,155	258	28,318	34,631

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Baca, Clear Creek, Logan, Mineral (1971), Phillips (1972), Prowers, Rio Blanco (1972), San Miguel, and some sand and gravel that cannot be assigned to specific counties.

Stone.—Production of stone totaling 4.5 million tons, was 19% higher than in the previous year. Thirty-eight counties had stone production from 116 quarries. The principal producer was Fremont County. Eight counties had output exceeding 100,000 tons; in addition to Fremont, they were Boulder, Chaffee, Douglas, El Paso, Jefferson, Larimer, and Weld.

Virtually all stone produced, 99%, was as crushed and broken stone; 8,850 tons was dimension stone. Principal uses of crushed and broken stone were for making cement and lime, and as flux stone, surface-treatment aggregate, and concrete aggregate. Limestone, including dolomite, was the principal stone produced, followed by sandstone and quartzite, and granite. Other types were marble, quartz, and miscellaneous stone.

Cooley Gravel Co. started a new 350-ton-per-hour crushed stone plant near Morrison. The company currently operates 3 sand and gravel plants in the Denver area. Because of declining resources of good gravel deposits, Cooley Gravel Co. will compliment the excess sand production with stone to supply the demand of an expanding building market. The company purchased 560 acres of land containing a 50-year supply of granitic rock resources.

Table 16.—Colorado: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough:				
Irregular-shaped stone and rubble Architectural thousand cubic feet	2	37	2	38
Monumental do	[1] 15	16	[1] 29	72
Other [2] do	26	23	14	17
Dressed:				
Architectural do	40	83	26	61
Monumental [3] do	10	154	15	58
Total thousand short tons	9	313	9	[4] 247
Crushed and broken stone:				
Bituminous aggregate	506	554	W	W
Concrete aggregate	846	1,331	W	2,273
Surface treatment aggregate	83	137	94	129
Unspecified aggregate and roadstone [5]	120	116	1,311	439
Riprap and jetty stone	120	460	212	439
Manufactured fine aggregate	W	W	W	52
Terrazzo	W	110	W	W
Other [6]	2,100	4,911	2,882	6,020
Total	3,775	7,619	4,499	9,352
Grand total [4]	3,785	7,933	4,507	9,599

W Withheld to avoid disclosing individual company confidential data; included with "Unspecified aggregate and roadstone."

[1] Rough monumental and architectural stone combined to avoid disclosing individual company confidential data.

[2] Data includes rough flagging and uses not specified.

[3] Data includes stone for flagging.

[4] Data may not add to totals shown because of independent rounding.

[5] Data includes stone used in roadbase stone.

[6] Data includes stone used in agricultural limestone (1972), cement and lime manufacture (1971), flux stone, refractory stone, roofing aggregates, chips, granules (1971), railroad ballast (1971), uses not listed in smaller amounts, and unspecified uses.

Table 17.—Colorado: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Dimension:				
Dolomite	W	W	W	W
Granite	W	W	W	W
Sandstone	8	157	8	155
Quartz	([1])	1	([1])	([1])
Undistributed	1	154	1	92
Total [2]	9	313	9	247
Crushed and broken:				
Limestone	2,512	5,375	3,343	7,217
Dolomite	W	W	--	--
Granite	490	759	W	W
Marble	--	--	W	W
Sandstone	70	96		
Quartz	17	194	[3] 215	616
Quartzite	W	W		
Traprock	382	W	--	--
Other stone	W	179	W	189
Undistributed	304	1,017	941	1,330
Total [2]	3,775	7,619	4,499	9,352
Grand total [2]	3,785	7,933	4,507	9,599

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit included with "Undistributed."

[2] Data may not add to totals shown because of independent rounding.

[3] Data combined to avoid disclosing individual company confidential data.

Table 18.—Colorado: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971 Number of quarries	1971 Quantity	1971 Value	1972 Number of quarries	1972 Quantity	1972 Value	Kind of stone produced in 1972
Adams	3	W	W	3	4	6	Granite.
Alamosa	1	([1])	1	--	--	--	
Baca	--	--	--	1	W	94	Limestone.
Clear Creek	1	W	W	2	8	14	Granite.
Custer	1	W	W	1	1	7	Other stone.
Denver	--	--	--	1	([1])	([1])	Granite.
Dolores	1	W	21	1	W	50	Sandstone.
Eagle	3	W	W	4	13	19	Granite.
Garfield	3	W	W	1	5	7	Do.
Grand	1	([1])	([1])	1	([1])	([1])	Do.
Gunnison	--	--	--	2	3	5	Do.
Hinsdale	1	W	W	1	([1])	2	Do.
Kit Carson	--	--	--	1	2	3	Do.
La Plata	2	W	W	1	9	13	Do.
Larimer	24	560	1,558	24	W	W	Limestone, granite, sandstone, quartz.
Mesa	4	W	16	2	5	43	Sandstone, quartz.
Moffat	--	--	--	3	5	7	Granite.
Montezuma	1	W	W	2	3	4	Do.
Otero	--	--	--	2	6	9	Do.
Pueblo	3	3	20	1	([1])	1	Do.
Saguache	1	W	12	1	([1])	([1])	Other stone.
San Miguel	2	W	W	1	W	6	Limestone.
Summit	--	--	--	2	13	20	Granite.
Weld	4	W	W	2	108	143	Granite, other stone.
Undistributed [2]	r 78	3,222	6,304	58	4,324	9,146	
Total [3]	133	3,785	7,933	116	4,507	9,599	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Arapahoe (1971), Archuleta, Boulder, Chaffee, Cheyenne, Delta (1972), Douglas, El Paso, Fremont, Gilpin, Huerfano (1971), Jackson (1971), Jefferson, Las Animas (1971), Lincoln (1972), Mineral (1972), Park, Prowers, Rio Blanco (1971), Rio Grande (1971), Sedgwick, Teller, Washington (1971), and Yuma (1971) Counties, and production for which no county breakdown is available.

[3] Data may not add to totals shown because of independent rounding.

Sulfur.—Elemental sulfur was recovered from acid gas, a byproduct of petroleum refining, by the Continental Oil Co. in Denver. Output in 1972 increased 97 long tons and was nearly 6% higher than in 1971. Elemental sulfur was not included in table 1 as a part of mineral production of Colorado because it is considered a secondary product.

Vermiculite.—Crude vermiculite shipped from Montana was exfoliated by W.R. Grace & Co. at its plant in Denver. The product was sold for use as loose-fill insulation material, concrete and plaster aggregate, soil conditioner, and miscellaneous purposes.

Table 19.—Principal producers

Commodity and company	Address	Type of activity	County
Carbon dioxide natural:			
Tenneco Oil Co	Box 2410 Denver, Colo. 80201	Well in McElmo field.	Montezuma.
Cement:			
Martin Marietta Cement	1111 S. Colo. Blvd. Denver, Colo. 80222	Dry process, 1-rotary-kiln plant.	Boulder.
Ideal Basic Industries, Inc	Box 231 Florence, Colo. 81226	Wet process, 2-rotary-kiln plant.	Fremont.
	Box 579 Fort Collins, Colo. 80521	Dry process, 2-rotary-kiln plant.	Larimer.
Clays:			
Conda Wesley	5323 Eldorado Springs Dr., Boulder, Colo. 80302	2 mines	Boulder.
Denver Brick & Pipe Co	Box 2329 Denver, Colo. 80201	Mine	Elbert.
Lakewood Brick & Tile Co	1325 Jay Street Lakewood, Colo. 80215	do	Jefferson.
The Idealite Co., a division of Ideal Basic Industries, Inc.	Box 1140 Boulder, Colo. 80302	Open pit mine and expanding plant.	Do.
George W. Parfet Estate Inc.	Box 266 Golden, Colo. 80401	Mine	Do.
Robinson Brick & Tile Co	Box 1619 Denver, Colo. 80223	Underground mine and 3 open pit mines.	Douglas.
H. M. Rubey Clay Co	Box 266 Golden, Colo. 80401	Mine	Jefferson.
Summit Press & Brick Co	Box 14 Trinidad, Colo. 81082	2 mines	Las Animas and Pueblo.
Coal, bituminous:			
CF&I Steel Corp	Box 316 Pueblo, Colo. 81002	Underground mine.	Do.
Energy Coal Co	2850 North Meridian St., Indianapolis, Ind. 46208	Strip mine and crushing plant.	Routt.
Mid-Continental Coal and Coke Co.	Carbondale, Colo. 81623	3 underground mines; cleaning and thermal drying plant.	Pitkin.
Peabody Coal Co	301 North Memorial Drive St. Louis, Mo. 63102	Strip mine and crushing plant.	Montrose.
		do	Routt.
Pittsburg & Midway Coal Mining Co.	Ten Main Center Kansas City, Mo. 64105	Strip mine; crushing and oil treatment plant.	Do.
United States Steel Corp. Western District-Coal.	Box 807 Dragerton, Utah 84520	Underground mine; cleaning and crushing plant.	Delta and Gunnison.
Copper:			
Idarado Mining Co	Ouray, Colo. 81427	*See* Zinc	Ouray and San Miguel.
Federal Resources Corp	Ouray, Colo. 81427	do	Ouray.
Standard Metals Corp	Box 2471 Silverton, Colo. 80217	do	San Juan.

Table 19.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Fluorspar:			
Industrial Chemicals Division, Allied Chemical Corp.	Box 228 Boulder, Colo. 80202	Underground mine and plant.	Boulder.
Ozark-Mahoning Co	Box 0 Cowdrey, Colo. 80434	do	Jackson.
Gold:			
Idarado Mining Co	Ouray, Colo. 81427 Telluride, Colo. 81435	*See* Zinc	Ouray and San Miguel.
Standard Metals Corp	Box 247 Silverton, Colo. 81433	do	San Juan.
Gypsum:			
Johns-Manville Products Corp.	Box 80 Coaldale, Colo. 81222	Open pit mine and wall-board plant.	Fremont.
Iron Ore: Pitkin Iron Corp.	105 West Adams St. Chicago, Ill. 60603	Open pit mine	Pitkin.
Lead:			
American Smelting & Refining Co.	Box 936 Leadville, Colo. 80461	*See* Zinc	Lake.
Federal Resources Corp	Ouray, Colo. 81427	do	Ouray.
Homestake Mining Co	Box 98 Creede, Colo. 81130	*See* Silver	Mineral.
Idarado Mining Co	Ouray, Colo. 81427 Telluride, Colo. 81435	*See* Zinc	Ouray and San Miguel.
New Jersey Zinc Co	Gilman, Colo. 81634	do	Eagle.
Standard Metals Corp	Box 2471 Silverton, Colo. 81433	do	San Juan.
Lime:			
The Great Western Sugar Co.	Box 5308 Denver, Colo. 80217	Pot-kiln plant	Adams.
		2 pot-kiln plants.	Boulder.
		do	Larimer.
		Pot-kiln plant	Logan.
		Shaft-kiln plant.	Morgan.
		Pot-kiln plant	Sedgwick.
		2 pot-kiln plants.	Weld.
CF&I Steel Corp	Box 316 Pueblo, Colo. 81002	Natural-frequency-vibrating kiln plant.	Pueblo.
Molybdenum:			
American Metal Climax, Inc.	Mines Park Golden, Colo. 80401	Underground mine and mill.	Clear Creek.
Petroleum:			
Champlin Petroleum Co	Box 9365 Fort Worth, Tex. 76107	Crude oil: Boxer field.	Morgan.
		Crude oil: Bison, Ramp, and Westfork fields.	Washington.
Chevron Oil Co., Western Division.	Box 599, 1700 Broadway Denver, Colo. 80201	Crude oil: Black Hollow and Pierce fields.	Weld.
		Crude oil plant: Rangely field.	Rio Blanco.
Continental Oil Co	Box 2197 Houston, Tex. 77001	Crude oil: McCallum field.	Jackson.
		Crude oil: Big Beaver, and Plum Creek fields.	Washington.
		Refinery	Adams.
El Paso Natural Gas Co	Box 1492 El Paso, Tex. 79999	Gas processing plant.	La Plata.
First General Resources Company, The Refinery Corp.	P. O. Box 1498 Denver, Colo. 80201	Refinery	Adams.

Table 19.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum—Continued			
International Nuclear Corp.	308 Lincoln Tower Bldg. Denver, Colo. 80203	Crude oil wells: Brandon field.	Kiowa.
Monsanto Co., Hydrocarbons & Polymers Division.	800 North Lindbergh Blvd. St. Louis, Mo. 63116	Crude oil wells: Battleship field.	Jackson.
		Crude oil: Marble Wash field.	Montezuma.
		Crude oil: Little East Beaver and Nugget fields.	Washington.
Amoco Production Corp	Box 591 Tulsa, Okla. 74102	Crude oil: Black Jack field.	Arapahoe.
		Crude oil: Cache field.	Montezuma.
		Crude oil: Big Beaver field.	Washington.
Texaco Inc	Box 2100 Denver, Colo. 80201	Crude oil: Danforth Hills and Maudlin Gulch fields.	Moffat.
		Crude oil: Wilson Creek field.	Rio Blanco.
Union Oil Co. of California, Northern Division.	1860 Lincoln St. Denver, Colo. 80203	Crude oil: Adena field.	Morgan.
Union Texas Petroleum	3000 Richmond Ave. Houston, Tex. 77001	Crude oil wells: Blade Lindon, Ranger, Ring, and Rush Willadel fields.	Washington.
Peat:			
H&H Trucking Co	136 Cornell St., Colorado Springs, Colo. 80911	Bog	Teller.
Universal Peat Co	5926 West Arizona Ave. Denver, Colo. 80226	Bog	Park.
Grefco, Inc	3450 Wilshire Blvd., Los Angeles, Calif. 90010	Expanding plant.	Conejos.
Perlite: Persolite Products, Inc.	Box 105 Florence, Colo. 81226	Open pit mine	Custer.
		Expanding plant.	Fremont.
Pumice:			
Colorado Aggregate Co., Inc.	Box 106 Mesita, Colo. 81142	Open pit mine and plant.	Costilla.
Dotsero Block Co., Inc	Box 933 Glenwood Springs, Colo. 81601	do	Eagle.
McCoy Aggregate Co	Box 575 McCoy, Colo. 80463	do	Routt.
Pyrites: Climax Molybdenum Co.	Climax, Colo. 80429	*See* Molybdenum.	Lake.
Sand and gravel (commercial):			
Asphalt Material & Paving Co.	14802 West 44th Ave. Golden, Colo. 80401	Pit and plant	Douglas.
		do	Garfield.
		Pit and 2 plants.	Jefferson.
		Pit and plant	Lincoln.
Big Thompson Sand & Gravel Co.	Star Rt., Box 442 Loveland, Colo. 80537	do	Larimer.
Brannan Sand & Gravel Co.	4800 Brighton Blvd. Denver, Colo. 80216	Pit and 4 plants	Adams.
		Pit and plant	Arapahoe.
		do	Jefferson.
Cooley Gravel Co	Box 313 Pueblo, Colo. 81002	7 pits and plant	Pueblo.
	5631 Tennyson St. Arvada, Colo. 80002	Pit and plant	Adams.
		2 pits and plants	Arapahoe.
L. G. Everist Inc	313 South Phillips Sioux Falls, S.Dak. 57102	Pit	Jefferson.
Golden Gravel Co	311 Kimbark St. Longmont, Colo. 80501	3 plants	Boulder.

Table 19.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel (commercial)—Continued			
Mobile Pre-Mix Sand and Gravel Co.	7620 Madison St. Denver, Colo. 80204	Pit and plant do	Adams. Arapahoe.
Peter Kiewit & Sons Co	5200 West Clifton Rd. Littleton, Colo. 80120	Pit	Douglas.
Plains Aggregate Co	P. O. Box 229 Boulder, Colo. 80302	do	Larimer.
Schmidt Construction Inc	P. O. Box 545 Arvada, Colo. 80002	Pit and plant	Pueblo.
Western Paving Construction Co.	5105 Washington St. Denver Colo. 80216	do	Adams.
Silver:			
American Smelting & Refining Co.	120 Broadway New York, New York 10005	*See* Zinc	Gunnison.
Idarado Mining Co	Ouray, Colo. 81427 Telluride, Colo. 81435	do	Ouray and San Miguel.
New Jersey Zinc Co	Gilman, Colo. 81634	do	Eagle.
Standard Metals Corp	Box 247 Silverton, Colo. 81433	do	San Juan.
Stone:			
Castle Concrete Co	Box 2379 Colorado Springs, Colo. 80901	2 quarries and plants.	El Paso.
CF&I Steel Corp	Box 489 Salida, Colo. 81201	Quarry and plant.	Chaffee.
	Box 847 Canon City, Colo. 81212	do	Fremont.
Cooley Gravel Co	Box 5485 Denver, Colo. 80217	Quarry	Jefferson.
Ideal Basic Industries, Inc	Box 231 Florence, Colo. 81226	Quarry and plant.	Fremont.
	Box 579 Fort Collins, Colo. 80521	do	Larimer.
Martin Marietta Cement, Western Division.	Box 467 Lyons, Colo. 80540	Quarry	Boulder.
Rocky Mountain Rock Products Inc.	3310 Fanfara St. Englewood, Colo. 80110	do	Jefferson.
Tin: Climax Molybdenum Co	Climax, Colo. 80429	*See* Molybdenum.	Lake.
Tungsten: Climax Molybdenum Co.	do	do	Do.
Uranium:			
Cotter Corp	Box 468 Golden, Colo. 80401	Underground mines and mill.	Fremont and Jefferson.
Union Carbide Corp., Mining and Metals Div.	Box 43, Rt. 1 Rifle, Colo. 81650	do	Garfield, Montrose, and San Miguel.
Union Carbide Corp., Mining and Metals Div.	Box 43, Rt. 1 Rifle, Colo. 81650	*See* Uranium	Do.
Zinc:			
American Smelting & Refining Co.	Box 936 Leadville, Colo. 80461	Mine and mill	Lake.
Federal Resources Corp	Ouray, Colo. 81427	do	Ouray.
Homestake Mining Co	Box 98 Creede, Colo. 81130	*See* Silver	Do.
Idarado Mining Co	Ouray, Colo. 81427	Underground mine and mill.	Do.
	Telluride, Colo. 81426	do	San Miguel.
New Jersey Zinc Co	Gilman, Colo. 81634	do	Eagle.
Standard Metals Corp	Box 247 Silverton, Colo. 81433	3 underground mines and mill.	San Juan.

The Mineral Industry of Connecticut

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Connecticut Geological and Natural History Survey for collecting information on all minerals except fuels.

By Robert A. Clifton [1]

The 18% increase in the value of Connecticut's mineral production in 1972, from $28.0 million to $33.1 million, was led by sand and gravel and stone. These commodities continued as the principal mineral products, and their combined production increased 10% in quantity and 20% in value.

There was a significant increase in the activities of State agencies and their contractors.

The Connecticut Geological and Natural History Survey had only one publication dated 1972, GQ–1023, Geology of the Eastford Quadrangle, Conn., but the U.S. Geological Survey published several maps. Three were surficial geologic maps: GQ–965 Ellington Quadrangle, GQ–983 Norfolk quadrangle, and GQ–984 Thomaston Quadrangle. The U.S. Geological Survey also published, in cooperation with the Connecticut Geological and Natural His-

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[1] Chemist, Division of Nonmetallic Minerals.

Table 1.—Mineral production in Connecticut [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays thousand short tons	174	$322	157	$292
Gem stones	NA	15	NA	16
Mica (scrap) thousand short tons	3	W	2	W
Sand and gravel do	6,921	10,262	6,763	11,270
Stone do	7,193	15,649	8,719	19,695
Value of items that cannot be disclosed: Feldspar, lime, and values indicated by symbol W	XX	1,713	XX	1,850
Total	XX	27,961	XX	33,123
Total 1967 constant dollars	XX	23,755	XX	p 27,586

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Connecticut, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Fairfield	$871	$711	Sand and gravel.
Hartford	7,433	10,659	Stone, sand and gravel, clays.
Litchfield	4,204	4,385	Stone, sand and gravel, lime.
Middlesex	2,186	2,044	Feldspar, sand and gravel, mica, stone, clays.
New Haven	9,600	10,368	Stone, sand and gravel, clays.
New London	1,253	1,543	Stone, sand and gravel.
Tolland	W	W	Sand and gravel.
Windham	W	W	Stone, sand and gravel.
Undistributed [1]	2,418	3,415	
Total [2]	27,961	33,123	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes sand and gravel, stone (1971), and gem stones that cannot be assigned to specific counties, and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

tory Survey, a series of 18 multicolored environmental maps of the Hartford North vicinity of the Connecticut Valley. The Hartford North Folio was published as U.S. Geological Survey Map I-784 (sheets A through R).

Table 3.—Indicators of Connecticut business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force..........thousands..	1,402.6	1,401.8	−0.1
Manufacturing..........do....	400.9	399.2	−0.4
Durable goods..........do....	288.5	285.6	−1.0
Nondurable goods..........do....	112.5	113.5	+0.9
Nonagricultural..........do....	1,166.6	1,179.7	+1.1
Unemployment..........percent of work force..	8.7	8.0	−8.0
Personal income:			
Total..........millions..	$15,322	$16,466	+7.5
Per capita..........	$4,995	$5,342	+6.9
Construction activity:			
Number of new housing units authorized..........	25,318	24,389	−3.7
Business activity:			
New incorporations..........	321	364	+13.4
Mineral production value..........thousands..	$27,961	$33,128	+18.5

p Preliminary.

Sources: New England Economic Indicators; Survey of Current Business; Construction Review; Area Trends in Employment and Unemployment; Employment and Earnings and Annual Report on the Labor Force and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Nonmetal..........	78	247	18	139	--	4	28.69	717
Sand and gravel..........	391	221	87	693	--	14	20.20	332
Stone..........	363	246	89	720	--	52	72.24	1,075
Total..........	827	234	194	1,552	--	70	45.10	711
1972:[1]								
Nonmetal..........	30	169	5	37	--	1	26.89	1,640
Sand and gravel..........	220	220	49	390	--	7	17.95	272
Stone..........	265	249	66	586	--	20	37.28	595
Total..........	515	232	120	[2] 964	--	28	29.06	504

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

[2] Data does not add to total shown because of independent rounding.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—There are no cement manufacturing plants in Connecticut. However, preliminary data on destinations of cement shipments indicate a 5% increase above the 1971 consumption of 833,984 short tons. Apparent 1972 consumption was 874,484 short tons.

Clays.—Common clay production decreased 10% in volume and sold for 90% of the 1971 value. The four mines operated by four companies were in Hartford, Middlesex, and New Haven Counties. Most of the clay was consumed in the manufacture of building brick; 5% was utilized by the ceramic and specialty clay products industry.

Feldspar.—The Feldspar Corp. mined feldspar from the Middleton and Hale mines and ground it at it's Middleton plant in Middlesex County. The ground feldspar was shipped to various States and Canada for use in manufacturing glass and pottery. Feldspar produced in Connecticut in 1972 increased 3% over 1971, but the production value increased only 2%.

Gem Stones.—Mineralogical societies, dealers, and individuals collected specimens from dumps, quarries, and pegmatite deposits in the State. The value of the collectors' items was about $16,000.

Gypsum.—National Gypsum Co. imported crude gypsum for processing into finished building plaster products and board and sheathing materials at its New Haven plant.

Lime.—Pfizer, Inc., produced lime in Litchfield County for mason's lime, sewage treatment, and other uses. Output increased 11% but was 29% below the 1965 record. The lime was consumed in Connecticut, Massachusetts, and other States. Total consumption of lime in Connecticut was 49,839 tons.

Sand and Gravel.—Commercial production decreased 2%, but total value of sand and gravel increased 10% from 1971 to 1972. The increase in total value was accompanied by a rise in the unit selling price from $1.48 per ton to $1.67. Government-and-contractor operations increased output greatly and reached 137% of the volume and 283% of the value of 1971.

Of the total 6.8 million tons produced, commercial operators sold or used 88%, and Government-and-contractor operations used 12%. The output was used primarily as aggregate in concrete for structural and paving construction. Other uses were fill, railroad ballast, molding sand, and other.

Sand and gravel was produced in each of the State's eight counties; the leaders were Hartford and New Haven Counties. Connecticut Sand Stone Corp., Waterbury Sand & Gravel Co., C. W. Blakeslee & Sons, Inc., and New Haven Trap Rock Co. (division of Ashland Oil, Inc.) were the leading producers.

Stone.—Production of stone increased 21% in volume and 26% in value.

Crushed basalt, used chiefly as construction aggregate and railroad ballast, was the major product in both volume and value.

Table 5.—Connecticut: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,983	3,005	1,365	2,308
Fill	352	331	251	237
Paving	939	1,456	1,596	2,717
Other uses [1]	425	634	206	259
Total [2]	3,700	5,426	3,418	5,522
Gravel:				
Building	1,178	1,991	925	1,791
Fill	417	221	319	235
Paving	976	1,742	995	1,593
Miscellaneous	--	--	142	197
Other uses	295	434	125	221
Total [2]	2,867	4,388	2,507	4,038
Government-and-contractor operations:				
Sand:				
Fill	15	30	12	3
Paving	22	18	27	29
Other uses	224	318	14	14
Total [2]	260	366	53	46
Gravel:				
Building	--	--	(3)	(3)
Fill	51	38	W	43
Paving	43	43	W	1,621
Total [2]	94	81	786	1,664
Total sand and gravel [2]	6,921	10,262	6,763	11,270

W Withheld to avoid disclosing individual company confidential data; included with total gravel.

[1] Includes foundry sand (1971).

[2] Data may not add to totals shown because of independent rounding.

[3] Less than ½ unit.

It was produced in Hartford, Litchfield, and New Haven Counties.

Crushed limestone and dolomite were produced in Litchfield County only, by three operators. It was marketed for metallurgical flux, soil neutralizer, lime manufacturing, and filler.

Crushed sandstone produced in Middlesex County was used in manufacturing fine aggregate and terrazzo. Quartz and quartzite were also produced for use in glass, asphalt filler, and abrasives. Dimension sandstone was produced in Windham County and sold primarily for use as rubble and in rough construction work. The dressed stone was marketed as building stone veneer.

Ashland Oil, Inc., Balf Co., and Roncari Industries, Inc., were the leading stone producers.

METALS

Pfizer Inc. at Canaan, Litchfield County, produced metallic barium and calcium, and an iron-copper powder registered under the trade name Prefiltron. This firm is the only known producer of calcium metal in the United States. Although the production of metallic magnesium has stopped, there was some sold during 1972.

Six steel mills in the State produced bars, rods, coils, strip, and wire rope. Approximately 75 foundries produced ferrous and nonferrous castings, and 11 foundries produced ferrous and nonferrous forgings and ingots. About 25 scrap metal dealers collected and processed ferrous metal for export and for sale to area foundries.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
The Michael Kane Brick Co	654 Newfield St. Middletown, Conn. 06475	Pit	Middlesex.
Keller Pottery Co	North Wales, Pa. 19454	Pit	Hartford.
Kelsey Ferguson Brick Co	East Windsor Hill, Conn. 06028	Pit	Do.
Plasticrete Corp., Stiles Brick Division	P.O. Box 248 North Haven, Conn. 06478	Pit	New Haven.
Feldspar: The Feldspar Corp.[1]	Spruce Pine, N.C. 28777	Pit	Middlesex.
Lime: Pfizer, Inc	Daisy Hill Road Canaan, Conn. 06018	Plant	Litchfield.
Gypsum (calcined): National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	New Haven.
Sand and gravel:			
Balf Co.[2]	190 Huyshope Ave. Hartford, Conn. 06106	Pit	Hartford.
C. W. Blakeslee & Sons, Inc.[2]	58 Waverly St. New Haven, Conn. 06511	Pit	Middlesex.
Connecticut Sand & Stone Corp	7 West Main St. Plainsville, Conn. 06062	Pit	Hartford and Litchfield.
M S G Corp	Box 5, Buckland Station Manchester, Conn. 06040	Pit	Hartford.
Meriden-Wallingford Sand & Stone Co., Inc.	No. Colony Rd. Wallingford, Conn. 06492	Pit	New Haven.
Oneglia & Gervasini Building Materials, Inc.[2]	P.O. Box 907 Torrington, Conn. 06790	Pit	Litchfield.
Roncari Industries, Inc	1776 South Main St. East Granby, Conn. 06026	Pit	Hartford.
Sega Sand & Gravel, Inc	271 Danbury Rd. New Milford, Conn. 06776	Pit	Litchfield.
Silliman Co	Low Bridge Road Southbury, Conn. 06488	Pit	Do.
Waterbury Sand & Gravel Co	551 So. Leonard St. Waterbury, Conn. 06708	Pit	New Haven.
Stone: Basalt, crushed and broken:			
Balf Co	190 Huyshope Ave. Hartford, Conn. 06106	Quarry	Hartford.
New Haven Trap Rock Co., div. of Ashland Oil, Inc.[3]	265 Church St. New Haven, Conn. 06511	do	New Haven.
Roncari Industries, Inc	1776 South Main St. E. Granby, Conn. 06026	do	Hartford.
York Hill Trap Rock Quarry Co	Westfield Rd. Meriden, Conn. 06450	do	New Haven.

[1] Also quartzite and scrap mica.
[2] Two operations.
[3] Also sand and gravel.

The Mineral Industry of Delaware

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Delaware Geological Survey for collecting information on all minerals except fuels.

By Robert T. MacMillian [1]

As in previous years the chief mineral output of Delware was sand and gravel of which 2.3 million tons was produced in 1972 valued at $2.7 million. Some clay was produced for brickmaking, and a minor quantity of gem stones also was produced. Production of magnesium compounds from sea water was initiated at Lewes.

In addition to the foregoing, other mineral production and mineral related activities in Delaware included the byproduct recovery of sulfur and iron cinder and the calcination gypsum. The total value of all minerals produced in Delaware was reported to be $2.9 million, an increase of 28% compared with the total value of minerals reported in 1971.

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[1] Physical scientist, Division of Nonmetallic Minerals.

Table 1.—Mineral production in Delaware [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays .... thousand short tons..	14	$8	15	$9
Gem stones	NA	2	NA	W
Sand and gravel .... thousand short tons..	2,205	2,231	2,257	2,660
Value of items that cannot be disclosed:				
Other nonmetals and value indicated by symbol W.	--	--	XX	202
Total	XX	2,241	XX	2,871
Total 1967 constant dollars	XX	1,906	XX	[1] 2,388

NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Indicators of Delaware business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Civilian work force .... thousands..	260.5	271.2	+4.1
Unemployment .... percent of work force..	14.0	12.3	−12.2
Manufacturing .... thousands..	69.5	72.3	+4.0
Contract construction .... do....	14.3	15.5	+8.4
Nonmanufacturing .... do....	149.2	159.3	+6.8
Personal income:			
Total .... millions..	$2,610	$2,815	+7.8
Per capita	$4,673	$4,983	+6.6
Construction activity:			
Cement shipments to Delaware .... thousand short tons..	179	191	+6.7
Mineral production value .... thousands..	$2,241	$2,871	+28.1

p Preliminary.

Sources: Survey of Current Business; U.S. Bureau of Mines; Employment and Earnings; Area Trends in Employment and Unemployment.

Table 3.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man days worked (thousands)	Man hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Nonmetal	2	313	1	5	--	--	--	--
Sand and gravel	55	184	10	81	--	3	36.81	810
Total	57	188	11	86	--	3	34.68	763
1972: [1]								
Sand and gravel	60	199	12	97	--	1	10.29	21
Total	60	199	12	97	--	1	10.29	21

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

Legislation and Government Programs.—Part one of a two-part cooperative Federal-State proposal for a comprehensive investigation of the economic potential of Delaware greensand deposits was accepted by the Bureau of Mines. The Bureau's contribution was in providing sampling techniques and analytical determinations. Greensand may be used as lightweight aggregate, and if the deposits prove to be adequate in size and favorably situated, they could become a valuable adjunct to the mineral industry of Delaware.

The Environmental Protection Agency approved the Delaware State clean air plan, which called for improvement in the emissions from a number of mineral-consuming establishments including Getty Oil Co.; Delamarva Power & Light Co.; Allied Chemical Corp; E. I. du Pont de Nemours & Co., Edgemoor plant; and North American Smelting Co. A number of State-operated facilities such as refuse incinerators were shutdown, and some coal-burning powerplants were switched to low-sulfur coal to avoid violating clean air standards.

A comprehensive study, "Energy, Oil, and the State of Delaware," was made by the Delaware Bay Oil Transport Committee, appointed by the Governor of Delaware in compliance with House Joint Resolution 18 of the Delaware State Legislature, which was passed in 1971. The findings of the committee, which delved deeply into the logistics of oil transport to and from Delaware River and Bay port facilities, were presented in a two-part report that was published January 15, 1973. The first part contains a summary and recommendations, and the second part contains the technical details developed in the study.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—The only producer of clay in Delaware in 1972 was Delaware Brick Co., which reported production of 15,480 tons, an increase of 11% compared with that of the previous year. The average unit value was 60 cents per ton. The clay was produced south of New Castle, and was used to produce building brick.

Gem Stones.—Small quantities of gem stones and mineral specimens were collected, chiefly by hobbyists.

Sand and Gravel.—In 1972 the sand and gravel output of Delaware increased 2% in quantity and 19% in value compared with corresponding figures in 1971. A total of 11 companies operated sand and gravel pits in 1972; seven were in New Castle County, three in Kent County, and one in Sussex County. The total production was 2,257,000 tons valued at $2,660,000 of which 935,000 tons valued at $1,208,000 was sand and 1,322,000 tons valued at $1,452,000 was gravel. Most of the sand and gravel produced was unprocessed.

Sixty-four percent of the sand and gravel produced in Delaware was used in paving; 22% in building, 12% as fill, and 2% in other uses. All sand and gravel was transported by truck.

Sulfur.—One company produced sulfur as a byproduct of the refining of imported crude petroleum. Delaware was the fifth largest producer of recovered sulfur.

METALS

Iron Compounds.—One company produced byproduct iron cinder for the cement industry.

Magnesium Compounds.—A small plant was built and operated by Barcroft Co., at Lewes to produce magnesium hydroxide (mil of magnesia) from sea water. The capacity of the plant was reported to be 5,000 tons annually, but the production in 1972 was minor.

Table 4.—Principal producers

Commodity and company	Address	Type of activity	County
Clays: Delaware Brick Co	River Rd. New Castle, Del. 19720	Pit	New Castle.
Gypsum, calcined: Georgia-Pacific Corp.	P.O. Box 311 Portland, Oreg. 97207	Plant	Do.
Magnesium compounds: Barcroft Co	P.O. Box 424 Lewes, Del. 19958	do	Sussex.
Sand and gravel:			
Barber Sand and Gravel	R.F.D. 1 Harrington, Del. 19952	Pit	Kent.
Clough & Caulk Sand & Gravel	Route 1, Box 129 Wyoming, Del. 19934	Pit	Do.
Delaware Sand & Gravel	R.D. 2, Box 286 New Castle, Del. 19720	Pit	New Castle.
George Nashold, Inc	Box 286 Frederica, Del. 19946	Pit	Kent.
Material Transit, Inc	Box 210 924 South Herald St. Wilmington, Del. 19800	Pit	New Castle.
Parkway Gravel, Inc	4048 New Castle Ave. New Castle, Del. 19720	Pit	Do.
Petrillo Brothers, Inc	Box 426 Wilmington, Del. 19809	Pit	Do.
St. Jones River Gravel Co	Box 426 Dover, Del. 19901	Pit	Do.
Swain Construction Co	Lincoln, Del. 19960	Pit	Sussex.
Whittington's Sand & Gravel Co	U.S. Route 40 Bear, Del. 19701	Pit	New Castle.
Woodlawn Gravel Co	Box 2561 Wilmington, Del. 19805	Pit	Do.

The Mineral Industry of Florida

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Florida Bureau of Geology.

By William F. Stowasser [1] and Woodson R. Oglesby [2]

The value of mineral production in Florida was $424.3 million. This was an increase of $81 million or 23% more than that in 1971. Cement, lime, magnesium compounds, natural gas, natural gas liquids, petroleum, stone, titanium concentrates, and zirconium concentrates all showed significant increases in production over 1971 levels. Monazite was produced for the first time since 1968. Recovered sulfur production increased 22-fold, and natural gas production increased 17-fold. Phosphate rock, perlite, staurolite, and kyanite concentrates reported smaller increases in production and value in 1972 compared with that of 1971.

For the 79th consecutive year, Florida produced more phosphate rock than any other State. Nationally, Florida again ranked first, in terms of value, in the production of fuller's earth, second in the production of titanium concentrates, and third in peat and kyanite production. Staurolite was not produced in any other State. Florida and North Carolina supplied 84% of the domestic phosphate rock market. Only Morocco exported more phosphate rock to world markets than did Florida. Florida increased exports 11% over the 1971 level; this represented 95% of phosphate rock exports from the United States. Exports from Florida moved through the ports of Tampa, Boca Grande, and Jacksonville to 27 countries. Japan and Canada each received over 2 million short tons, and over 1 million short tons was shipped to Western Europe.

Crude petroleum production by Humble Oil & Refining Co. from the Jay field in the northern Panhandle near the Alabama border is expected to increase to 93,000 barrels per day.

Although the development trend was continuous, production buildup from the Jay field was basically a function of planned construction. In 1972 there were one 2,000-barrel-per-day, three 6,500-barrel-per-day, and three 12,000-barrel-per-day nominal capacity field separators for a field total of 57,500 barrels per day. Three 12,000-barrel-per-day separating plants will complete the facilities. The last one was due to start up early in 1972. Ultimate fieldwide separator capacity will be 93,500 barrels per day.

Legislation and Government Programs.—The Governor of Florida signed into law, bills providing for coordinated management of Florida's water resources, purchase of environmentally endangered forests, and State control of land use development. The "Florida Environmental Land and Water Management Act of 1972" will have an effect on the phosphate mining industry. The section on water management gives the Department of Natural Resources the power to conserve, protect, and manage all the waters of the State. The Department of Natural Resources will establish a Statewide water use plan that will impose regulations on well drilling and all consumptive uses of water. The land use section allows the State to purchase or rigidly control development of about 5% of the State's land area. These lands will be designated to be of critical concern to the State and be protected.

The Attorney General of the State of Florida has renewed his request for a hearing on his motion for a preliminary injunction against the issuance of phosphate mining leases in the Osceola National Forest. The State filed suit in 1971 against the Secretaries of the U.S. Department of the Interior and the U.S. Department of Agriculture after it was disclosed that preferential rights leases had been applied for by several companies in the Osceola National Forest. A moratorium was placed on the issuance of leases by the Secretary of the Interior to permit completion of environmental impact statements. The Attorney General contended that the Environmental Protection Act and other statutes superseded the mining laws that direct the Federal Government to issue mining permits if specified conditions are met.

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[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Assistant administrator—Oil and Gas, Florida Dept. of Natural Resources.

A 5% corporate profit tax was enacted by a special session of the Florida State legislature in December 1971 and will affect the mining industry in Florida in 1972. The corporate profit tax was predicted to generate approximately $150 million a year.

On April 1, 1972, the State of Florida was paid a total of $1,221,659 in severance taxes for phosphate rock mined from July 1 through December 31, 1971. The initial 6-month payment was based on a 3% assessment rate. This rate will increase to 4% on July 1, 1973, and 5%, July 1, 1975. The value per ton of phosphate rock assigned by the Department of Revenue for tax purposes was $3.11. Of the $1,221,659 total, $258,718 was deducted from the ad valorem tax paid to the county in which the company operated (21%), one-half of the remainder, $481,470 (39%), was returned to the industry for land reclamation, and the remainder, $481,470 (40%), was deducted from Federal taxable income. The Federal tax credit was $231,105 (19%). The industry payment to the State was reduced by deductions and tax credits to $250,354 for a 6-month period.

A new Statewide ban on high-phosphate detergents was announced by the Florida State Pollution Control Board. Effective the first of 1973, the rule limits the phosphorus content of soaps and detergents to 8.7%. This is the same ceiling imposed by the States of Connecticut, Indiana, Maine, Michigan, and New York. Dade County has banned the sale of detergents containing any phosphorus. Some cities, including Chicago, Ill., and Buffalo, N.Y., have total bans on phosphate detergents. The Florida ceiling of 8.7% phosphorus content in detergents applies only to laundry products, not to automatic dishwashing detergents or personal hygiene products, that is, shampoo or toothpaste. Detergents sold for industrial or institutional use were also exempted from the phosphorus limitation.

The Florida Pollution Control Board adopted safety regulations designed to prevent damaging slime spills from holding ponds associated with phosphate rock processing operations. The Board tightened requirements for construction, operation, and maintenance of dams designed to retain the slimes. The new rules set minimum standards on the dams and emphasized intensive surveillance by State inspectors.

Table 1.—Mineral production in Florida [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland ... thousand short tons	2,177	$48,970	2,425	$59,773
Masonry ... do	180	4,877	218	6,901
Clays [2] ... do	993	12,834	922	10,336
Lime ... do	159	2,958	180	3,527
Natural gas ... million cubic feet	908	270	15,521	4,967
Peat ... thousand short tons	57	412	45	362
Petroleum (crude) ... thousand 42-gallon barrels	5,347	W	16,897	W
Sand and gravel ... thousand short tons	23,228	18,836	20,752	15,025
Stone ... do	42,816	64,332	[3] 53,098	[3] 81,621
Value of items that cannot be disclosed: Kaolin (clay), kyanite, magnesium compounds, natural gas liquids, phosphate rock, rare-earth metal concentrates, staurolite, stone (shell) (1972), titanium concentrates, zircon concentrates, and values indicated by symbol W	XX	190,242	XX	241,775
Total	XX	343,731	XX	424,287
Total 1967 constant dollars	XX	292,274	XX	p 352,964

p Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

[3] Excludes shell; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production, in Florida, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Alachua	$1,596	$1,741	Stone.
Bay	94	W	Sand and gravel.
Bradford	W	W	Natural gas liquids.
Brevard	W	W	Stone, sand and gravel.
Broward	13,627	18,226	Stone, zircon concentrates, sand and gravel.
Calhoun	W	W	Sand and gravel.
Charlotte	W	W	Do.
Citrus	2,274	W	Stone, clays, phosphate rock.
Clay	W	W	Titanium concentrates, staurolite, clays, zircon concentrates, kyanite, rare-earth metals.
Collier	W	5,548	Stone, petroleum.
Dade	55,022	67,982	Cement, stone, sand and gravel.
Escambia	W	9,079	Petroleum, natural gas, sand and gravel, clays.
Franklin	4	3	Peat, sand and gravel.
Gadsden	11,808	9,568	Clays, sand and gravel.
Gilchrist	W	W	Phosphate rock.
Gulf	W	W	Magnesium compoundns, lime.
Hamilton	W	W	Phosphate rock.
Hendry	W	W	Petroleum, sand and gravel, natural gas.
Hernando	W	W	Stone, lime, phosphate rock.
Hillsborough	W	W	Cement, sand and gravel, peat, phosphate rock.
Indian River	--	W	Sand and gravel.
Jackson	W	W	Stone, sand and gravel.
Lake	1,600	1,767	Sand and gravel.
Lee	W	W	Stone, petroleum.
Leon	409	W	Sand and gravel.
Levy	W	W	Stone.
Marion	2,634	3,205	Stone, clays, sand and gravel, phosphate rock.
Monroe	W	W	Stone.
Okaloosa	W	W	Sand and gravel.
Orange	W	W	Peat.
Palm Beach	1,038	W	Stone.
Pinellas	W	W	Stone, sand and gravel.
Polk	150,725	155,238	Phosphate rock, sand and gravel, peat.
Putnam	W	1,571	Sand and gravel, clays, peat.
St. Lucie	1,589	W	Sand and gravel.
Santa Rosa	[2] W	35,625	Petroleum, natural gas, sand and gravel.
Sarasota	--	W	Sand and gravel.
Sumter	W	7,135	Stone, lime, peat.
Suwannee	W	W	Stone.
Taylor	W	W	Do.
Walton	W	W	Sand and gravel.
Undistributed [3]	101,315	107,602	
Total [4]	343,731	424,287	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Baker, Columbia, De Soto, Dixie, Duval, Flagler, Glades, Hardee, Highlands, Holmes, Jefferson, Lafayette, Liberty, Madison, Manatee, Martin, Nassau, Okeechobee, Osceola, Pasco, St. Johns, Seminole, Union, Volusia, Wakulla, and Washington.

[2] Includes value of petroleum and natural gas from Escambia County.

[3] Includes value of counties indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Florida business activity.

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total nonagricultural employment thousands	2,249.2	2,407.5	+7.0
Manufacturing do	317.3	334.7	+5.5
Mining do	9.2	9.3	+1.1
Contract construction do	180.1	203.9	+13.2
Other nonagricultural employment [1] do	1,742.6	1,859.6	+6.7
Personal Income:			
Total millions	$27,611	$30,397	+10.1
Per capita	$3,930	$4,188	+6.6
Construction activity:			
Housing units authorized	161,585	282,279	+74.7
Value of nonresidential construction millions	$848.4	$1,190.4	+40.3
Highway construction contract awards do	$278.6	[e] $210.0	−24.6
Farm marketing receipts do	$1,473.4	$1,680.7	+14.1
Mineral production value do	$343.7	$424.3	+23.5
Export trade value do	$1,131.8	$1,319.2	+16.6
Import trade value do	$1,173.6	$1,609.0	+37.1

[p] Preliminary. [e] Estimate.

[1] Includes transportation and public utilities; services; wholesale and retail trade; finance, insurance, and real estate; and government.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; U.S. Bureau of Mines; and Highlights of U.S. Exports and Imports Trade.

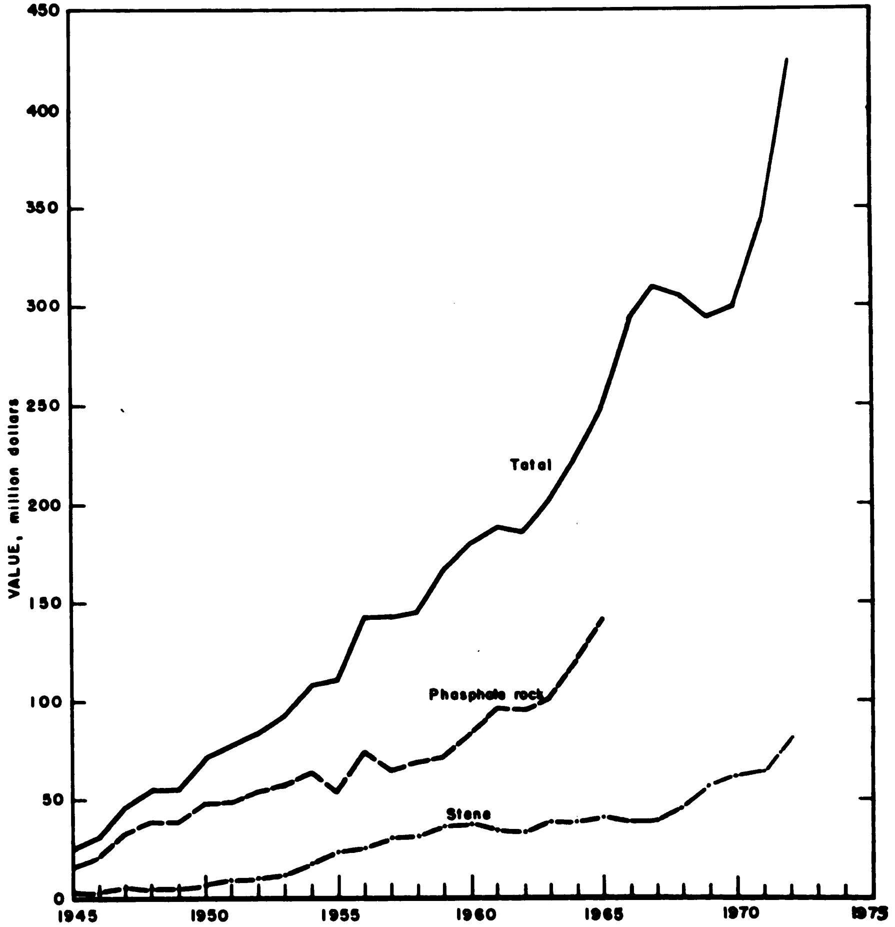

Figure 1.—Value of phosphate rock, stone, and total value of mineral production in Florida

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	145	364	53	422	--	--	--	--
Nonmetal	3,523	314	1,106	8,862	1	78	8.91	1,422
Sand and gravel	562	248	140	1,284	--	37	28.81	1,304
Stone	2,838	307	871	7,533	6	163	22.43	5,777
Total [1]	7,068	307	2,169	18,102	7	278	15.74	3,193
1972: [2]								
Metal	160	366	58	463	--	1	2.16	615
Nonmetal	2,955	321	949	7,602	--	35	4.60	103
Sand and gravel	345	261	91	804	--	27	33.57	397
Stone	1,900	281	535	4,717	1	151	32.23	1,747
Total [1]	5,360	305	1,632	13,586	1	214	15.83	709

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

A research program aimed at solving the problem of disposing of waste phosphate slimes produced from beneficiating Florida and similar type phosphate rock was started.[3] The Florida Phosphate Council, representing 10 operating Florida companies, and the U.S. Bureau of Mines are sponsoring the work with the cost of the program equally shared. The purpose of the program will be to develop an economically acceptable procedure to dewater slimes. If this can be accomplished, construction of earth dams to impound the slimes will not be necessary, and the slimes as well as the sand tailings can be used to reclaim mined land. The technology could be advantageously applied to North Carolina, Tennessee, and possibly western States' phosphate tailings.

Experimental studies by the Bureau of Mines to recover phosphates and metals from sludges generated in phosphate coating processes indicate that the process is technically feasible and economically attractive. Trisodium phosphate, zinc, and iron are recovered. After the sludge is dissolved in hydrochloric acid, the iron as ferric chloride is concentrated in isopropyl ether, zinc is extracted by 2-diethylhexyl phosphoric acid in kerosine, and phosphate is recovered by crystallization from the raffinate.

A number of research projects were underway at the Bureau of Mines Albany Metallurgy Research Center in Albany, Oreg. These were (1) the recovery of fluorides from phosphate rock, (2) direct acidulation of phosphate ore with sulfuric acid, specifically, land-pebble phosphate ore from Florida to minimize slime formation, and (3) a study of processes to separate phosphate minerals from carbonates in western phosphate ores.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Nonmetals represented 81%, fuels 15%, and metals 4% of the value of the State's total mineral production in 1972. The principal nonmetals produced were, in decreasing order of value, phosphate rock, stone, cement, sand and gravel, and clays.

Cement.—Shipments of portland and masonry cement increased over 1971 levels reflecting the strong demand for cement from the construction industry. Consumption of cement in 1971 was over 3.7 million short tons and in 1972 was in excess of 5.3 million short tons. Portland cement shipments in 1972 increased 11%, and masonry cement shipments increased 18% over levels in 1971. Portland cement shipments were 2.4 million short tons, and masonry cement shipments were 213,000 short tons. The value of portland cement and masonry cement shipments was $59.8 million and $6.9 million respectively and showed gains of 22% for portland cement and 42% for masonry cement compared with values reported in 1971.

Although the number of cement plants in Florida has not changed since 1966, plants have expanded production facilities. For example, Maule Industries, Inc., is increasing clinker grinding capacity from a level of about 0.5 million short tons in 1972-73 to 1.2 million in 1974 and 2.2 million in 1975. General Portland, Inc., completed conversion of their Tampa plant to use aragonite in the cement manufacturing process as a replacement for limestone. The aragonite is dredged from the Carribbean and is expected to reduce costs and improve cement quality.

The consumption pattern of portland cement in the State was 50% in ready-mix concrete, 17% in building materials, 10% to contractors, and the balance was used in miscellaneous applications.

Clays.—Total clay production and value decreased from 1971 levels.

Fuller's earth production decreased 18% in quantity and its value decreased 21% from those of 1971. Florida's fuller's earth production was the second highest in the Nation. Two companies operated mines in Gadsden County, and one company operated a mine in Marion County. Fuller's earth was used for fillers, absorbers, pesticides, drilling mud, filter aids, and other purposes.

Kaolin production increased 7% and value increased 42% over that of 1971.

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[3] The Florida Times Union (Lakeland, Florida). Waste Clay Disposal Plan is Outlined. Oct. 17, 1972, p. 21.
U.S. Bureau of Mines. Joint Research on Florida's Phosphate Waste Announced by Mines Bureau. Press Release, Nov. 4, 1972, p. 1.

Kaolin was produced from two mines in Putnam County for manufacturing china and dinnerware.

Production of common clay for manufacturing cement, lightweight aggregate, and building brick increased 1.5% in quantity and 2% in value. Four companies in Citrus, Clay, Escambia, and Gadsden Counties produced common clay.

Gypsum.—Imported crude gypsum was processed into various building products at two plants in Duval County and one in Hillsborough County. The three plants used nine kettles, one rotary kiln, and one Holoflite unit to calcine gypsum products.

U.S. Gypsum Co., National Gypsum Co., and Kaiser Cement & Gypsum Corp., calcined gypsum in Duval and Hillsborough Counties.

A total of 594,000 short tons of calcined gypsum was produced, an increase of 15% over 1971 production. The value of the production was approximately $7.0 million, a 21% increase over 1971 value.

Crude gypsum was imported from mines in Nova Scotia, Canada.

Kyanite.—E. I. du Pont de Nemours & Co. recovered a small quantity of kyanite-sillimanite mixture from a beach sand deposit in Clay County. The mixture was a byproduct of a heavy minerals separation plant to recover titanium minerals. The kyanite-sillimanite mixture was sold to refractory manufacturers. Production and value increased 4% and 5%, respectively, above 1971 levels.

Lime.—Quicklime and lime hydrate sold or used totaled 180,000 short tons and was valued at nearly $3.5 million. Compared with that of 1971, both quantity and value increased 13.2% and 20.8%, respectively.

Basic Magnesia, Inc., Gulf County; Chemical Lime, Inc., Hernando County; and Dixie Lime and Stone Co., Sumter County, produced lime for paper and pulp industries, recovery of magnesia from seawater, construction, waste neutralization, water treatment, and other chemical processes. Lime consumption in the State exceeded production.

Magnesia.—Basic Magnesia, Inc., Port St. Joe, Gulf County, produced caustic calcined magnesia and refractory-grade magnesia from seawater. The plant's design capacity is 60,000 short tons per year; however, it has not produced at design level. Sales increased 9% from 1971 levels, and the reported value increased 42%.

Perlite.—From ore mined in Colorado and New Mexico, four companies produced 19,124 short tons of expanded perlite compared with 17,547 short tons in 1971. Of the production, over 18,000 short tons valued at $1,001,000 were sold or used. Sales and value increased 9% and 10%, respectively, over 1971 levels. Plants were located in Dade, Duval, Escambia, and Indian River Counties.

The expanded perlite was principally used in plaster aggregates, formed products, and concrete aggregates with minor quantities consumed filling masonry cavities and conditioning soil.

Phosphate Rock.—The production of marketable phosphate rock from Florida and North Carolina increased 6% over that of 1971. Because TexasGulf, Inc., is the only producer in North Carolina and its production is concealed, the production from the two States are combined. Phosphate rock provided the major part of mineral production and value of the State.

The combined production of marketable phosphate rock from both States was 34.1 million short tons. The value of the marketable rock increased to $174 million, an increase of $6 million or 3.7%. Of the total production in the United States, Florida and North Carolina's share was 83.6%.

The quantity of marketable rock sold or used from Florida and North Carolina increased 11.3% compared with the quantity reported in 1971. With sales and consumption greater than production, stocks of marketable phosphate rock declined from 12 to 10.5 million short tons or 12% during 1972. Marketable phosphate rock sales and consumption totaled 36.9 million short tons valued at $188.3 million. This was an increase of 8% in value over that of 1971.

Of the total sold or used, 63% was consumed in the domestic agricultural market. The balance, 37%, largely was exported with a minor part used in industrial applications. The consumption distribution pattern of the domestic fraction was 22,889,000 tons (98.0%) for fertilizer, 177,000 tons (0.8%) for elemental phosphorus, and 289,000 tons (1.2%) for defluorinated rock and other applications.

Most of the 13,992,000 short tons of marketable phosphate rock that was exported in 1972 was exported from Florida and represented an increase of 10.3% above 1971 export levels.

The percent distribution by grade of marketable rock sold or used from Florida and North Carolina was as follows:

Grade percent BPL[1]	Percent distribution
Less than 60	0.1
60 to 66	5.1
66 to 70	44.8
70 to 72	11.2
Over 72	38.8

[1] 1.0 BPL (bone phosphate of lime or tricalcium phosphate) = 0.458% P_2O_5.

The average grade of phosphate ore mined was 13.9% P_2O_5, and the average grade of marketable rock was 32.2% P_2O_5. The average weight recovery of concentrate and marketable rock as mined was 29.1%, and the average P_2O_5 recovery was 67.4%.

Land-pebble phosphate rock was produced by 12 companies from 17 open pit mines in three Florida counties.

Soft phosphate rock was produced by five companies operating six open pit mines in three Florida counties. Total soft rock sold or used was 20,607 short tons equivalent to 4,056 short tons P_2O_5, and it was valued at $120,895. The product was used for direct soil fertilization and animal feed supplements.

The assets of Agrico Chemical Co., a division of Continental Oil Co., were purchased by the Williams Co., Tulsa, Okla. Agrico Chemical Co. will operate as a wholly-owned subsidiary of Williams.[4] Agrico Chemical Co. announced plans to improve its dock facilities at Donaldsonville, La., and begin a $50 million, 400,000-ton-per-year equivalent P_2O_5 phosphoric acid plant at this location. Completion is scheduled for mid-1974.[5]

C.F. Industries, Inc., plans to double the size of its fertilizer manufacturing complex at Plant City.[6] The expansion will increase finished product capacity to 650,000 tons per year of fertilizer.

International Minerals & Chemical Corp. (IMC) plans to construct a fertilizer complex in central Florida. Production of 600,000 tons per year of diammonium phosphate and triple superphosphate is scheduled for 1974.

The Phosphate Rock Export Association (Phosrock) established headquarters in Tampa, and after July 1, 1972, handled the sales and distribution of phosphate rock in the export market for Agrico Chemical Co., American Cyanamid Co., W. R. Grace & Co., IMC, and Occidental Petroleum Corp.

The Florida State Pollution Control Board limited the phosphorus content of soaps and detergents to 8.7%. Dade County banned the sale of phosphorus-bearing soaps and detergents. The Board also adopted new regulations designed to prevent phosphate slime dam failures. The regulations specify requirements for construction and maintenance, as well as surveillance by State inspectors.

Occidental Petroleum Corp. announced that to maintain its domestic market position and expand markets abroad, the Suwannee River mine in northern Florida will be expanded to increase production to 3.4 million tons of marketable phosphate rock by late 1973.[7] A new 45-cubic-yard dragline will be added to assist two existing machines. Plans are also underway to increase the production of superphosphoric acid.

Although Occidental's superphosphoric acid capacity is only 225,000 tons per year, Occidental is negotiating with the U.S.S.R. to supply 1 million tons per year in exchange for ammonia and urea.[8]

Sand and Gravel.—Sand and gravel production totaled 20.8 million tons valued at $15 million in 1972. The combined production from Dade, Lake and Polk counties was 38% of the total State production. Over 90% of the State's production was distributed by truck, and the remainder was shipped by rail. The production was consumed by the construction industry for building sand, paving sand and gravel, and other miscellaneous uses.

Florida Mining & Materials Corp., Tampa, constructed a $750,000 concrete block plant that will be operated by its Tampa Sand and Materials Div. The firm's Aggregate Div., Brooksville Rock, completed an expansion that increased capacity to 3 million tons per year. The new glass sand plant of Edgar Plastic Kaolin Co. is onstream near Plant City. The plant was

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[4] Chemical Marketing Reporter. Agrico Unit Changes Hands. V. 201, No. 19, May 8, 1972, p. 3.

[5] The Tampa Tribune. Agrico Expanding. Sept. 22, 1972, pp. 7–13.

[6] CF Industries, Inc. Annual Report, 1972. P. 11.

[7] Occidental Petroleum Corp. 1972 Annual Report. P. 19.

[8] European Chemical News. Occidental Proposes Huge USA-USSR Fertilizer Deal. V. 22, No. 552, Sept. 29, 1972, p. 8.

Table 5.—Florida: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Bay	3	87	94	3	W	W
Broward	2	W	W	3	760	W
Dade	4	W	W	5	2,218	W
Escambia	5	585	342	8	978	622
Lake	6	1,843	1,600	5	1,852	1,767
Orange	1	243	181	--	--	--
Palm Beach	1	62	81	--	--	--
Polk	12	3,187	3,665	8	3,760	4,645
Putnam	4	765	908	3	W	W
Santa Rosa	--	--	--	1	3	(1)
Undistributed [2]	r 18	r 16,456	r 12,067	23	11,180	7,990
Total [3]	56	23,228	18,836	59	20,752	15,025

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Brevard, Calhoun, Charlotte, Clay (1971), Franklin, Gadsden (1972), Hendry, Hillsborough, Indian River (1972), Jackson, Leon, Marion, Okaloosa, Pinellas, St. Lucie, Sarasota (1972), and Walton Counties.

[3] Data may not add to totals shown because of independent rounding.

Table 6.—Florida: Sand and gravel sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Building sand	8,687	8,764	7,386	7,488
Paving sand	1,276	1,280	3,253	3,148
Paving gravel	499	775	W	W
Other sand and gravel [1]	12,767	8,018	10,113	4,388
Total sand and gravel [2]	23,228	18,836	20,752	15,025

W Withheld to avoid disclosing individual company data; included with "Other sand and gravel."

[1] Includes glass, blast, engine, filtration, fill, railroad ballast (1971), and other sands; miscellaneous gravel (1971), and building gravel (1972).

[2] Data may not add to totals shown because of independent rounding.

designed to operate at 125 tons per hour to produce specification sand for the glass industry.

Staurolite.—Florida was the only State that produced commercial quantities of this complex silicate of iron and aluminum mineral in 1972. It was recovered as a byproduct from the heavy minerals separation plants of E. I. du Pont de Nemours & Co. at Highland and Trail Ridge, Clay County. Production increased 1% and the value of the production increased 11% in 1972 compared with the respective production and value reported in 1971.

Stone.—Crushed limestone and dolomite production was 53.1 million tons and was valued at $81.6 million. Tonnage and value increased 31% and 36%, respectively, over 1971 levels. Limestone and dolomite was produced from 75 quarries in 16 counties compared with 65 quarries in 15 counties in 1971. Dade, Broward, and Hernando Counties were, in the order noted, the leading limestone-producing counties in the State, supplying 73% of the total tonnage and 72% of the total value. Nine companies operated 26 quarries, and their combined production represented 62% of the State's production and 63% of the total value.

Seventy-nine percent of the crushed limestone was hauled by truck, 15% by rail, 0.6% was transported on water, and 5.4% of the total was moved by unspecified methods.

Oystershells were processed in two counties for roadbase material, and a minor quantity was sold for other uses. This was a decrease of 21% in tonnage and 16% in value below 1971 levels.

Sulfur.—The recovery of sulfur as a byproduct of oil and natural gas production in Escambia and Santa Rosa Counties increased from a 1971 production level of

Table 7.—Florida: Crushed limestone and dolomite sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971 [1]			1972		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Alachua	4	1,817	1,596	4	2,166	1,741
Brevard	2	W	W	1	185	192
Broward	16	6,939	10,661	19	9,278	14,613
Citrus	2	W	W	4	W	1,039
Collier	3	W	W	4	1,766	W
Dade	12	13,596	18,570	15	21,100	26,752
Hernando	5	7,657	12,480	5	8,617	17,186
Levy	2	115	W	3	415	W
Marion	5	844	W	5	1,099	2,486
Palm Beach	5	733	1,007	3	W	W
Sumter	3	3,317	3,782	3	4,693	W
Undistributed [2]	r 6	5,441	11,222	9	3,773	17,611
Total [3]	65	40,458	59,819	75	53,093	81,621

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Data for 1971 does not include dolomite.

[2] Includes Jackson (1972), Lee, Monroe, Suwannee, and Taylor Counties.

[3] Data may not add to totals shown because of independent rounding.

Table 8.—Florida: Crushed limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971 [1]		1972	
	Quantity	Value	Quantity	Value
Bituminous aggregate	2,721	5,104	3,843	6,488
Concrete aggregate	9,275	15,714	16,573	28,042
Dense graded road base stone	15,552	21,706	17,270	24,678
Macadam aggregate	(2)	(2)	848	492
Other roadstone [3]	1,562	2,093	--	--
Unspecified aggregate and roadstone	2,911	3,072	4,824	4,249
Agricultural purposes [4]	502	1,782	1,084	4,273
Cement and lime manufacture	3,761	4,128	W	W
Fill	999	776	3,029	3,219
Stone sand	2,673	3,953	2,335	3,100
Railroad ballast	W	W	861	688
Other uses [5]	501	1,041	3,977	6,448
Total [6]	40,458	59,819	53,093	81,621

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Data for 1971 does not include dolomite.

[2] Data included with "Other roadstone," to avoid disclosing individual company confidential data.

[3] Data include stone used for macadam and surface treatment aggregate.

[4] Data include agricultural limestone and stone used in poultry grit and mineral food.

[5] Data include stone used in other fillers and uses not specified. 1972 data also include stone used in riprap and surface treatment aggregate.

[6] Data may not add to totals shown because of independent rounding.

4,059 long tons to 87,842 long tons. Total sales increased from 3,861 in 1971 to 85,915 long tons in 1972. Expansion of oil and gas production is expected, and associated recovery of sulfur as a byproduct is projected to increase almost 3-fold in 1973.

Vermiculite.—Exfoliated vermiculite was produced from six plants in Dade, Duval, Hillsborough, and Palm Beach Counties. Compared with 1971 production and value, 1972 production and value declined 12.5% and 8%, respectively.

METALS

Ferroalloys.—Three companies produced ferrophosphorus as a byproduct of elemental phosphorus manufacture. The value of ferroalloys is not included in the total State mineral production value.

Rare-Earth Minerals.—Titanium Enterprises produced monazite concentrates from a new plant near Green Cove Springs in Clay County. Neither production, shipments nor value may be published.

Titanium Concentrates.—Titanium Enterprises, a new company formed by American Cyanamid Co. and Union Camp Corp., produced heavy minerals from an ancient beach sand deposit near Green Cove Springs. Conventional dredging equipment is used followed by wet gravity, magnetic, and high-tension concentrating processes.

Both shipments and value of ilmenite concentrates increased 28% and 23%, respectively, in 1972 compared with 1971 shipments and value. Production of rutile was reported for the first time from this mine in 1972.

Zircon Concentrates.—Sales of zircon concentrates, recovered from the E. I. du Pont de Nemours & Co. ilmenite concentration plants at Highland and Trail Ridge, Clay County, improved compared with shipment levels in 1971. Tonnage sold or used increased 29% over that in 1971, and the value of shipments was 25% higher than that reported in 1971. The zirconium sands were used in ferrous foundries, refractories, and in ceramics.

MINERAL FUELS

Mineral fuels produced were natural gas, natural gas liquids, crude petroleum, and peat.

Natural Gas.—Total net sales of natural gas in Florida during 1972 was nearly 13 billion cubic feet. The actual gas production reported at the wellhead was about 19% greater than this amount. The difference between the two figures represents unavoidable losses, that is, "shrinkage." These losses occurred from the lease use of gas in operating pumps, and principally from the use of Jay field gas to operate the facilities to remove acid gas (H_2S) and to convert the gas to elemental sulfur. An average of 7½ long tons of 99% pure sulfur is recovered per million cubic feet of gas processed.

During 1972, the reported value of approximately 13 billion cubic feet of gas processed and sold in Florida was about $3¼ million. The reported sales value for Jay gas was about $0.25 per thousand cubic feet. It is assumed that natural gas liquids that increased the normal Jay gas 1,050 Btu content to about 1,400 Btu increased the selling price proportionately. If the undersaturated reservoir at Jay and the two nearby Smackover-Norphlet fields produce salable gas with oil throughout the primary recovery period at the current gas-oil ratio (about 1,250 to 1), the estimated reserves are 157½ billion cubic feet of gas. If the same ratio were to be maintained during secondary recovery operations, the reserves would triple as would the projected oil recovery.

Peat.—Peat production decreased from 57,000 short tons valued at $412,000 in 1971 to 45,000 short tons valued at $362,000 in 1972. These were decreases of 21% and 12% in production and value, respectively. Eight operations produced humus, moss, and reed-sedge peat in six counties. The majority of sales were in bulk form with 60% sold for packing flowers, plants, and shrubs; 20% sold for general soil improvement; and 20% sold for earthworm culture and as an ingredient for potting soils.

Petroleum.—The cumulative total of crude oil produced in Florida from 1943-72 was 41,671,950 barrels. Of this amount, 16,897,189 barrels were produced in 1972, a threefold increase over the 1971 production. Daily oil production in Florida is at a current rate of approximately 90,000 barrels, and 84% is produced in the Jay field. Per barrel prices ranged from $2.66 for heavy crude (about 25° gravity API) from the Lehigh Acres field to $3.29 for high-gravity (about 51° API) sour crude from the Jay field in Santa Rosa County. During 1972, nine fields were producing in the State. Six of the fields are located in the Sunniland Limestone producing trend in Collier, Hendry, and Lee Counties. The other three are located in Santa Rosa County. Jay field production extends into Escambia County and across the State line into Alabama where that portion of the field is known as Little Escambia Creek field. The fields in northwest Florida produce from the Smackover Limestone and the underlying Norphlet Sand, which is the main productive formation at Mt. Carmel field.

In summary, hydrocarbon production in Florida occurs only in the Lower Cretaceous limestone in south Florida at depths ranging around 11,500 feet. In northwest Florida, hydrocarbon production has been established only in the Jurassic limestone and sand at depths of about 15,500 feet. The usual spacing pattern in Florida is 160 acres per well. Exceptions to this are at Sunniland, where 40-acre well spacing is employed, and at Blackjack Creek field, where 320 acres per well has been adopted.

"Primary" reserves in Florida are estimated to range from 165 million recoverable stock tank barrels to 414 million barrels if secondary measures, that is, fluid injection, are employed. "Primary" recovery includes artificial lift by pumping that is employed at the start of the productive period in south Florida's fields. Although the Sunoco-Felda field is being repressurized by water injection, this procedure is not used in other south Florida fields because an almost unlimited water drive generates about double the primary recovery usually obtained from limestone reservoirs. In the Jay field and at Blackjack Creek field, water injection to pressurize the reservoirs will probably be required in 1974 or 1975. It is anticipated that the total recoverable oil at Jay will be increased from about 115 million barrels to 300 million barrels with this procedure.

Table 9.—Florida: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Alachua	--	--	--	--	--	1	1	2,980
Charlotte	--	--	--	--	--	1	1	18,232
Collier	--	--	--	--	--	5	5	60,122
Escambia	10	--	1	--	--	5	16	256,586
Hendry	8	--	--	--	--	6	9	102,351
Lake	--	--	--	--	--	1	1	5,397
Lee	1	--	--	--	--	4	5	58,516
Monroe	--	--	--	--	--	1	1	12,662
Okaloosa	--	--	--	--	--	1	1	14,514
Osceola	--	--	--	--	--	2	2	14,885
Putnam	--	--	--	--	--	1	1	5,572
St. Johns	--	--	--	--	--	1	1	4,584
Santa Rosa	49	--	3	2	--	8	62	992,975
Walton	--	--	--	--	--	2	2	23,561
Washington	--	--	--	--	--	1	1	11,692
Total	68	--	4	2	--	40	109	1,579,529

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 10.—Principal producers

Commodity and company	Address	Type of activity	County
Cement, portland and masonry:			
General Portland, Inc., Southeast Division.	Box 22848 Tampa, Fla. 33622	2 plants	Dade and Hillsborough.
Lehigh Portland Cement Co.	718 Hamilton St. Allentown, Pa. 18105	Plant	Dade.
Pennsaco Cement & Aggregates Subsidiary of Maule Industries, Inc.	100 Biscayne Blvd. Miami, Fla. 33132	do	Do.
Clays:			
Fuller's earth:			
Engelhard Minerals & Chemicals Corp.	Menlo Park Edison, N.J. 08817	2 open pit mines	Gadsden.
Floridin Co.	Berkley Springs, W. Va. 25411	Open pit mine	Do.
Mid-Florida Mining	Box 68-F Lowell, Fla. 32663	do	Marion.
Kaolin:			
Edgar Plastic Kaolin Co.	Edgar, Fla. 32049	do	Putnam.
Miscellaneous:			
Appalachee Correctional Institute.	Box 127 Chattahoochee, Fla. 32324	do	Gadsden.
Bickerstaff Clay Products Co., Inc.	Box 1178 Columbus, Ga. 31902	Open pit mine and plant.	Escambia.
Florida Solite Co.	Box 297 Green Cove Springs, Fla. 32043	do	Clay.
General Portland Cement Co.	Box 1528 Tampa, Fla. 33601	Open pit mine	Citrus.
Gypsum, calcined:			
Kaiser Cement & Gypsum Corp.	300 Lakeside Drive Oakland, Calif. 94612	Plant	Duval.
National Gypsum Co.	325 Delaware Ave. Buffalo, N.Y. 14202	do	Hillsborough.
U.S. Gypsum Co.	101 S. Wacker Drive Chicago, Ill. 60606	do	Duval.
Lime: Primary:			
Basic Magnesia, Inc.	Box 160 Port St. Joe, Fla. 32456	do	Gulf.
Chemical Lime, Inc.	Box 250 Ocala, Fla. 32670	do	Hernando.
Dixie Lime & Stone Co.	Box 910 Ocala, Fla. 32670	do	Sumter.

Table 10.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Magnesium compounds:			
Basic Magnesia, Inc	Box 160 Port St. Joe, Fla. 32456	Plant	Gulf.
Peat:			
Oxford Peat Co	Box 154 Oxford, Fla. 32684	Bog	Sumter.
Peace River Peat, Inc	P.O. Box 1192 Bartow, Fla. 33830	Bog	Polk.
F. E. Stearns Peat	Rt. 1 Box 347-I Valrico, Fla. 33594	Bog	Hillsborough.
Traxler Peat Co	Box 86 Florahome, Fla. 32635	Bog	Putnam.
Zellwood Peat Co	Box 397 Zellwood, Fla. 32798	Bog	Orange.
Perlite, expanded:			
Airlite Processing Corp	Rt. 3 Box 417 Vero Beach, Fla. 32960	Plant	Indian River.
Armstrong Cork Co	Box 351 Pensacola, Fla. 32502	do	Escambia.
Chemrock Corp	End of Osage St. Nashville, Tenn. 37208	do	Duval.
W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 02140	Plants	Broward and Dade.
Petroleum:			
Humble Oil & Refining Co	Box 2024 Houston, Tex. 77001	Jay field	Santa Rosa.
Sun Oil Company	Box 2880 Dallas, Tex. 75221	Sunoco-Felda field	Collier and Hendry.
Refinery: Seminole Asphalt Refining, Inc.	Box 128 St. Marks, Fla. 32355	Plant	Wakulla.
Phosphate rock:			
Land pebble:			
Agrico Chemical Co	Box 3166 Tulsa, Okla. 74101	3 open pit mines	Polk.
Borden, Inc	Box 790 Plant City, Fla. 33566	Open pit mine	Do.
Brewster Phosphates	Bradley, Fla. 33835	do	Do.
Cities Service Co	Box 3269 Tampa, Fla. 33601	do	Do.
W. R. Grace & Co	Box 471 Bartow, Fla. 33830	do	Do.
International Minerals & Chemical Corp.	Box 867 Bartow, Fla. 33830	3 open pit mines	Do.
Mobil Oil Corp., Chemical Div.	Box 311 Nichols, Fla. 33863	2 open pit mines	Do.
Occidental Petroleum Corp., Suwannee River Phosphate Div.	Box 300 White Springs, Fla. 32096	Open pit mine	Hamilton.
Swift Agricultural Chemicals Corp.	Box 208 Bartow, Fla. 33830	2 open pit mines	Polk.
U.S.S. Agri-Chemicals, Inc.	Box 867 Ft. Meade, Fla. 33841	do	Do.
Phosphorus, elemental:			
Agrico Chemical Co	5050 Poplar Ave. Memphis, Tenn. 38117	3 electric furnaces	Do.
Mobil Chemical Co	Box 311 Nichols, Fla. 33863	Electric furnace	Do.
Sand and gravel:			
General Development Corp.	1111 South Bayshore Dr. Miami, Fla. 33131	3 open pit mines	Brevard, Charlotte, St. Lucie.
E. R. Jahna Industries, Inc.	First & East Tillman Lake Wales, Fla. 33853	Open pit mine	Lake and Polk.
Ortona Sand Co	First and East Tillman Lake Wales, Fla. 33853	Dredge	Hendry.
Seminole Rock Products, Inc.	8100 N.W. 74th St. Miami, Fla. 33166	do	Dade.
Standard Sand & Silica Co	Box 35 Davenport, Fla. 33837	Open pit mine	Polk.
Staurolite: E. I. du Pont de Nemours & Co.	Du Pont Bldg., D-10084 Wilmington, Del. 19898	Plant	Clay.
Stone:			
Limestone, crushed:			
Dixie Lime & Stone Co.	Box 910 Ocala, Fla. 32670	5 quarries	Jackson, Levy, Marion, Sumter.
Florida Rock Industry Corp.	Box 4667 Jacksonville, Fla. 32201	2 quarries	Hernando and Suwannee.
General Development Corp.	1111 South Bayshore Dr. Miami, Fla. 33166	3 quarries	Charlotte and St. Lucie.
Houdaille-Duval-Wright Co.	Box 8068 Seminole Annex Ft. Lauderdale, Fla. 33310	5 quarries	Alachua, Broward, Dade.
Maule Industries, Inc.	Box 2601 Hialeah, Fla. 33012	2 quarries	Broward and Dade.

Table 10.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Oystershell:			
Bay Dredging & Construction Co.	Box 1484 Tampa, Fla. 33601	Dredge	Hillsborough.
Benton & Company, Inc.	Box 1347 St. Petersburg, Fla. 33731	do	Pinellas.
Houdaille-Duval-Wright Co.	Box 1588 Jacksonville, Fla. 32201	do	Duval.
Radcliff Materials, Inc.	Box 1288 Mobile, Ala. 36601	do	Walton.
Titanium concentrates:			
E. I. du Pont de Nemours & Co.	Du Pont Bldg. D-10084 Wilmington, Del. 19898	2 dredges and plants.	Clay.
Titanium Enterprises	Box 1036 Green Cove Springs, Fla. 32043	Mine and plant	Do.
Vermiculite, exfoliated:			
W. R. Grace & Company	62 Whittemore Ave. Cambridge, Mass. 02140	4 plants	Dade, Duval, Hillsborough, Palm Beach.
Zircon concentrates:			
E. I. du Pont de Nemours & Co.	Du Pont Bldg. D-10084 Wilmington, Del. 19898	Plant	Clay.
Titanium Enterprises	Box 1036 Green Cove Springs, Fla. 32043	Mine	Do.

The Mineral Industry of Georgia

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Georgia Department of Natural Resources, Earth and Water Division, under a cooperative agreement for collecting information on all minerals except fuels.

By J. Robert Wells [1] and Sam M. Pickering, Jr.[2]

The total value of Georgia's mineral production, riding on a wave of 19 annual increases in a row and placing Georgia 29th in the Nation in that respect, exceeded a quarter of a billion dollars in 1972, a figure 12% above that for the previous year and the highest in the history of the State. Deserving of major credit for the higher total in 1972 were Georgia's clays, especially kaolin, up $11.6 million or 11%, and stone, up $12.6 million or 18%.

As one phase of an extensive streamlining of State agencies taking effect in early 1972, Governor Jimmy Carter designated the Earth and Water Division of the newly established Georgia Department of Natural Resources to assume the functions of the former Department of Mines, Mining and Geology. Sam M. Pickering, Jr., second in command in the prior agency, was named to be the first director of the new division and to fill the post of State Geologist.

The United States currently imports virtually all its requirements of bauxite for conversion to alumina, the source of all primary aluminum metal produced at domestic smelters. Imports of bauxite and alumina were valued at more than $300 million in 1972, a figure that is projected to reach at least $1,000 million within the next 15 years. Those sums underline the importance of the report "Alumina from Kaolin Potentials" released by the Georgia Department of Industry and Trade which presented the results of a research project launched in 1971 by Governor Jimmy

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[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

[2] State geologist and Director, Earth and Water Division, Georgia Department of Natural Resources.

Table 1.—Mineral production in Georgia [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland..........thousand short tons..	1,214	$22,470	1,260	$27,286
Masonry..........do....	68	1,470	68	1,569
Clays [2]..........do....	5,791	119,096	6,227	132,322
Peat..........do....	1	13	W	W
Sand and gravel..........do....	3,697	5,310	3,816	4,729
Stone..........do....	30,669	69,897	37,074	82,484
Talc..........short tons..	53,000	334	45,842	338
Value of items that cannot be disclosed: Barite, bauxite, fire clay, feldspar, iron ore, kyanite, mica (scrap), rare-earth mineral concentrates, titanium concentrates, zircon concentrates, and values indicated by the symbol W..........	XX	r 10,895	XX	9,313
Total..........	XX	r 229,485	XX	258,041
Total 1967 constant dollars..........	XX	195,181	XX	p 214,664

p Preliminary. r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

Carter and carried out by Georgia Institute of Technology. The $50,000 study was funded mainly by the Coastal Plains Regional Commission, which also made available an additional $15,000 for furthering negotiations for Federally supported pilot plants in Georgia, preferably operated or supervised by the Bureau of Mines. The Department of Industry and Trade administered the research contract and the promotional activities involved in the project, to which a number of other State agencies also contributed funds or services.

Representatives of a majority of Georgia's

Table 2.—Value of mineral production in Georgia by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Baldwin	W	--	
Bartow	$5,046	$3,747	Barite, stone, clays.
Bibb	W	1,810	Clays, sand and gravel.
Charlton	W	W	Titanium, zircon, rare-earth mineral concentrate.
Chatham	W	W	Sand and gravel.
Cherokee	W	W	Mica.
Clarke	975	1,088	Stone.
Clayton	W	W	Do.
Cobb	W	W	Do.
Columbia	W	8	Clays.
Cook	--	W	Sand and gravel.
Crawford	W	W	Do.
Dawson	--	W	Stone.
Decatur	W	W	Clays.
De Kalb	5,612	6,401	Stone, sand and gravel.
Dougherty	W	W	Sand and gravel.
Douglas	W	W	Stone, clays.
Early	W	W	Stone.
Effingham	W	W	Sand and gravel.
Elbert	2,609	W	Stone.
Evans	57	W	Sand and gravel.
Fayette	W	1,584	Stone.
Floyd	W	2,694	Stone, clays.
Forsyth	--	W	Stone.
Fulton	17,891	19,892	Cement, stone, clays, sand and gravel.
Gilmer	W	1,145	Stone.
Greene	W	W	Stone, sand and gravel.
Gwinnett	W	W	Stone.
Hall	W	W	Do.
Hancock	W	W	Stone, clays.
Hart	W	W	Mica.
Houston	W	W	Cement, stone, clays.
Jasper	W	W	Feldspar, stone.
Jefferson	W	1,184	Clays.
Jones	W	W	Stone.
Lee	--	W	Sand and gravel.
Lincoln	W	W	Kyanite.
Long	W	W	Sand and gravel.
Lowndes	168	W	Peat.
McDuffie	--	W	Clays.
Madison	W	W	Stone.
Miller	4	W	Peat.
Mitchell	--	W	Stone.
Monroe	W	W	Do.
Montgomery	W	W	Sand and gravel.
Morgan	W	--	
Murray	334	371	Talc, stone.
Muscogee	W	3,316	Stone, sand and gravel.
Oglethorpe	1,562	1,075	Stone.
Pickens	W	W	Do.
Pike	--	W	Sand and gravel.
Polk	W	8,355	Cement, stone, clays.
Quitman	W	W	Iron ore.
Rabun	W	W	Stone.
Richmond	4,581	5,808	Stone, clays, sand and gravel.
Screven	8	--	
Stephens	W	W	Stone.
Stewart	W	W	Iron ore.
Sumter	2,880	5,693	Clays, bauxite, sand and gravel.
Talbot	W	W	Sand and gravel.
Taylor	W	--	
Thomas	4,854	4,209	Clays, sand and gravel.
Troup	--	W	Stone.
Twiggs	42,271	44,386	Clays.
Union	--	W	Stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Georgia, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Walker	$3,289	W	Stone, clays.
Ware	W	W	Sand and gravel.
Warren	W	$9,159	Clays, stone, sand and gravel.
Washington	45,655	44,198	Clays.
Whitfield	W	2,100	Stone.
Wilkinson	W	17,970	Clays.
Undistributed	r 92,189	72,460	
Total [2]	r 229,428	258,043	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Appling, Atkinson, Bacon, Baker, Banks, Barrow, Ben Hill, Berrien, Bleckley, Brantley, Brooks, Bryan, Bulloch, Burke, Butts, Calhoun, Camden, Candler, Carroll, Catoosa, Chattahoochee, Chattooga, Clay, Clinch, Coffee, Colquitt, Coweta, Crisp, Dade, Dodge, Dooly, Echols, Emanuel, Fannin, Franklin, Glascock, Glynn, Gordon, Grady, Habersham, Haralson, Harris, Hart, Heard, Henry, Irwin, Jackson, Jeff Davis, Jenkins, Johnson, Lamar, Lanier, Laurens, Liberty, Lumpkin, McIntosh, Macon, Marion, Meriwether, Morgan, Newton, Oconee, Paulding, Peach, Pierce, Pulaski, Putnam, Randolph, Rockdale, Schley, Seminole, Spalding, Taliaferro, Tattnall, Taylor, Telfair, Terrell, Tift, Toombs, Towns, Treutlen, Turner, Upson, Walton, Wayne, Webster, Wheeler, White, Wilcox, Wilkes, and Worth.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Georgia business activity

		1971	1972 p	Change, percent
Employment and labor force, annual average:				
Total work force available	thousands	1,988.6	2,057.4	+3.5
Total unemployed	do	78.4	76.9	−1.9
Employment:				
Manufacturing	do	460.2	473.2	+2.8
Transportation and public utilities	do	106.1	109.8	+3.5
Mining	do	7.0	7.1	+1.4
Contract construction	do	85.0	93.8	+10.4
Service	do	202.3	217.7	+7.6
Government	do	309.6	320.9	+3.6
Wholesale and retail trade	do	350.1	362.9	+3.7
Finance, insurance, and real estate	do	82.6	85.2	+3.1
Personal income:				
Total	millions	$16,786	$18,152	+8.1
Per capita		$3,599	$3,846	+6.9
Construction activity:				
Number of private and public residential units authorized		74,702	63,611	−14.8
Value of authorized nonresidential construction	millions	$307.4	$420.1	+36.7
Cement shipments to and within Georgia:				
Portland	thousand short tons	2,172	2,506	+15.4
Masonry	do	218	243	+11.5
Farm marketing receipts	millions	$1,317.2	$1,502.2	+14.0
Mineral production value	do	r $229.5	$258.0	+12.4
Export trading	do	$341.2	$408.0	+19.6
Import trading	do	$348.0	$466.2	+34.0

p Preliminary. r Revised.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Highlights of U.S. Export and Import Trade; and U.S. Bureau of Mines.

mineral producers convened in June at Macon and established the Georgia Association of Mineral Producing Industries, Inc. The organizing committee presented for review and comment a series of proposed bylaws for the new association, the stated aims of which are to advance and encourage the State's mineral resource industries, to express the mineral industries' views on legislation, and to improve public relations for the State's mineral producers and their supporting industries.

The Georgia Surface Mined Land Use Board published the proceedings of a Symposium on Rehabilitation of Drastically Disturbed Surface Mined Lands. The symposium had been attended by about 250 representatives of various mining and environmental interests. The proceedings discussed grading and slopes, soil placement, management of surface waters, protection of existing streams, dust control, sanitary landfills, landscape design, and selection of trees, grasses, and legumes for vegetative

Table 4.—Georgia: Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	118	318	38	318	--	7	22.01	421
Nonmetal	3,877	307	1,189	9,571	1	251	26.33	1,848
Sand and gravel	228	266	61	549	--	15	27.31	444
Stone	2,912	264	769	6,711	2	148	22.35	2,390
Total	7,135	288	[1] 2,056	17,149	3	421	24.72	1,989
1972: [2]								
Metal	95	321	31	265	--	2	7.56	151
Nonmetal	3,485	318	1,108	8,907	--	244	27.39	1,421
Sand and gravel	185	270	50	458	--	14	30.59	284
Stone	1,915	267	510	4,511	1	73	16.40	1,929
Total	5,680	299	1,699	14,141	1	333	23.62	1,523

[1] Data do not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

cover. The same agency (subsequently replaced by the Land Reclamation Section, Environmental Protection Division, of the newly organized Department of Natural Resources) also published a directory of the State's surface mining industry.[3]

A development of major importance to Georgia's mining industry especially to those branches involved in interstate, coastwise, and foreign trade, was the completion in 1972 of a modern terminal at Savannah that provides facilities for expeditious loading, unloading, intermediate handling, covered storage, and transhipment of a wide variety of bulk commodities transported by railroad, trucks, barges, or ocean-going vessels. The new installation, incorporating the advantages of advanced engineering concepts, was described as achieving an economic breakthrough for the industries it will serve.

The Southwire Co. copper smelting and refining complex at Carrollton, Carroll County (about 30 miles west of Atlanta) went into pratically full-scale production in 1972. The new plant, providing integrated facilities for the blast-furnace reduction of a variety of copper-containing materials and the electrolytic treatment of blister copper and scrap, is designed to supply 72,000 tons of refined copper annually for the company's rod and wire fabricating operations in Georgia, Arkansas, Kentucky, New Jersey, and Puerto Rico.

In an investigation with potential implications regarding the State's mineral future, University of Georgia scientists undertook a study of the application of an innovative nuclear detection system to determine the location, extent, and possible commercial value of mineral deposits on the continental shelf along Georgia's Atlantic coast. The new procedure, faster and cheaper than the core sampling technique used hitherto, involves traversing the areas of interest by a ship towing an undersea sled equipped with a high-intensity neutron source to induce secondary radiations characteristic of the elements within range. Detection and intensity measuring devices on the sled derive qualitative and quantitative information from natural or induced radiation signals concerning the minerals encountered and relay it to the towing vessel. Georgia's nearby seabottom formations are known to include concentrations of phosphate and thorium, and discovery of other minerals of possible economic importance was thought likely.

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[3] Georgia Surface Mined Land Use Board. Surface Mining Operators. Macon, Ga., April 1972, 15 pp.

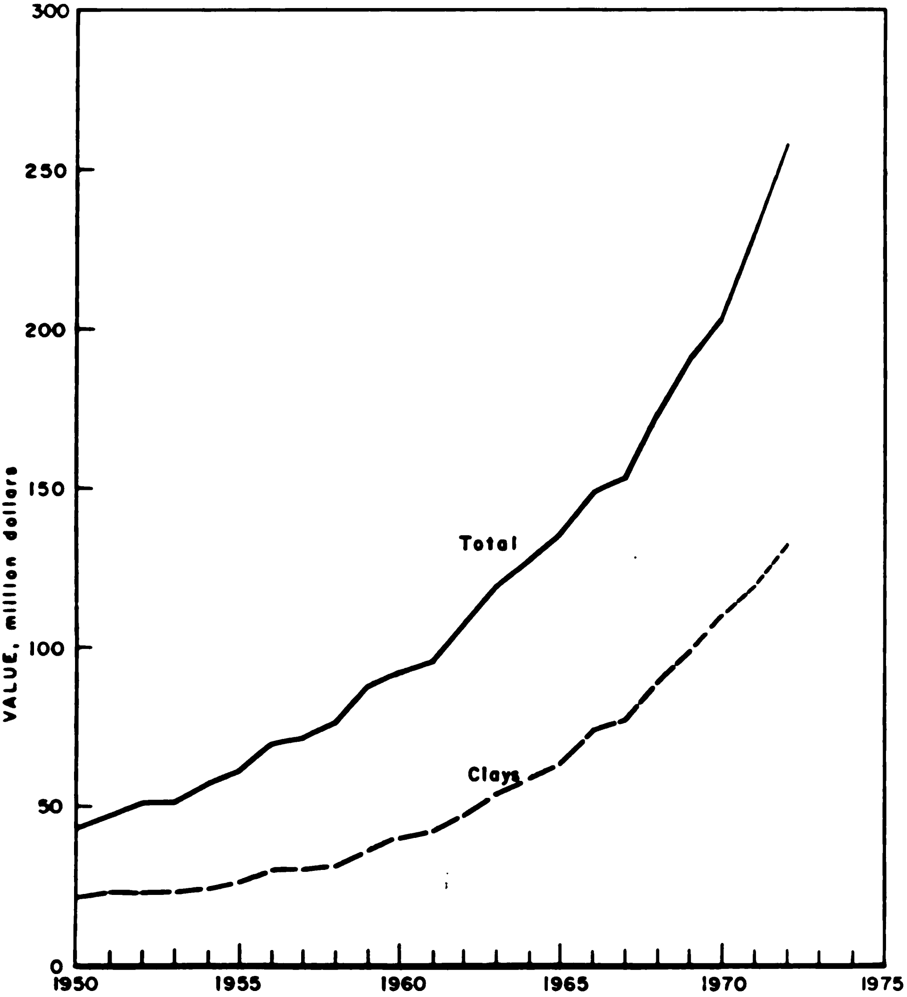

Figure 1.—Value of clays, and total value of mineral production in Georgia.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Barite.—New Riverside Ochre Co. and Paga Mining Co., produced barite in 1972, each from one open pit mine in Bartow County. Total output was 27% less in tonnage and 34% less in value than in 1971 when there were three producers. The mineral was ground for use as a filler, extender, or pigment for paints and rubber products; as a raw material in the manufacture of chemicals and glass; as a densifying additive for oil-well drilling muds; and in heavy-aggregate concrete.

Cement.—Three companies manufactured cement in Georgia in 1972. Marquette Cement Manufacturing Co. produced dry-process portland cement in a plant at Rockmart, Polk County; Southern Cement Co., a division of Martin-Marietta Corp., operated a dry-process plant producing both portland and masonry cements in Atlanta, Fulton County; and Medusa Cement Co., a division of Medusa Corp., produced both portland and masonry cements in a wet-process plant at Clinchfield, Houston County. Shipments of portland cement from State producers in 1972 were 4% greater in volume than in 1971 and 21% more in total value; masonry cement shipments were up 8% in volume and 7% in value. Consumption of cement in Georgia in 1972 was 2,739,000 tons. Medusa announced a $13-million expansion and modernization plan for the Clinchfield plant (newly acquired from Penn-Dixie Cement Corp.) scheduled for completion around yearend 1973. The project involves installation of a new dry-process kiln 15 feet in diameter by 200 feet in length that will increase clinker capacity by 75%.

Clays.—Georgia, long established in first place among the 50 States in regard to total value of clay production, remained securely in that positioin in 1972, and clays continued to be, as usual, Georgia's primary source of mineral income. Clays in one or more classifications, kaolin, fuller's earth, common clay, and fire clay (listed in descending order of economic importance in the State), were mined from open pit operations in each of 20 counties, providing altogether 51% of the total value of Georgia's 1972 mineral production. Twiggs, Washington, Wilkinson, Warren, and Sumter Counties were the leaders in value of clays produced.

Kaolin ranked first in the State in terms of both tons and dollars and accounted for 64% of the quantity and 91% of the value of the clays produced in Georgia in 1972. The year's kaolin output, derived from operations of 18 firms in McDuffie, Richmond, Sumter, Twiggs, Warren, Washington, and Wilkinson Counties, amounted to 8% more in quantity than in 1971 and was 11% higher in total value. American Industrial Clay Co. of Sandersville, Engelhard Minerals & Chemicals Corp., Freeport Kaolin Co., Georgia Kaolin Co., J. M. Huber Corp., and Thiele Kaolin Co. jointly contributed 73% of the State's total 1972 kaolin tonnage and 84% of the corresponding value.

Information recently available made it possible to report in 1972 for the first time the various fractions of total kaolin output by the classifications, unprocessed, air-floated, water-washed, delaminated, or calcined.

Thiele Kaolin Co. opened its Reedy Creek facility at Wrens, Jefferson County. The new plant, completely integrated and centrally monitored, was designed to effect substantial savings in the large-scale processing of air-floated kaolin for use in the manufacture of paper and ceramics and for other purposes. As part of a major expansion of production capacity, Anglo-American Clays Corp. installed new spray-dryers and other new equipment at the company's plant at Sandersville, Washington County, which features the preparation of 90-brightness kaolin in a number of grades suitable for paper coating. Engelhard Minerals & Chemicals Corp. increased production capacity for calcined kaolin by the installation of a new rotary kiln, 9½feet in diameter, at McIntyre, Wilkinson County.

An article described the equipment and processes used by Mulcoa, a division of Combustion Engineering, Inc., at Andersonville, Sumter County, in preparing a number of grades of aggregate of specified and closely controlled alumina content from kaolin, bauxtic clay, and bauxite.[4] Refractories manufacturers in the United States consume a large part of the Mulcoa aggregate, but substantial quantities are exported to England, West Germany, Japan, and other countries. The addition of three new rotary kilns, placed in service in 1972, raised the production capacity of the Mulcoa facility from 100,000 tons per year to about a quarter million tons.

Georgia's kaolin industry was reviewed in a series of articles in a British journal.[5]

Fuller's earth was produced in Georgia in 1972 from open-pit mines in Thomas County by Waverly Mineral Products Co., Oil Dri Corp. of Georgia, and Thor Mining Co. Div. of Pennsylvania Glass Sand Co.; in Decatur County by Engelhard Minerals & Chemicals Corp. and Milwhite Co., Inc.; in Jefferson County by Georgia-Ten-

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[4] Jeffers, P. E. Custom Aggregate Fills Refractory Needs. Brick & Clay Record, V. 160, No. 6, June 1972, pp. 36–39.

[5] Industrial Minerals (London). Kaolin in the USA; Growth in Paper Coating Revolutionises the Industry. No. 51, December 1971, pp. 9–30.

Collingan, R. V. Freeport Kaolin Co. Leader in Kaolin Technology. Ind. Miner. (London). No. 51, December 1971, pp. 23–25.

Industrial Minerals (London). Huber Offers Broad Product Line of Kaolin Clays to a Variety of Industries. No. 51, December 1971, pp. 27–28.

Industrial Minerals (London). Dixie Clay Co. A Smaller Producer Well Known to the Rubber Industry. No. 51, December 1971, pp. 29–30.

Table 5.—Georgia: Kaolin sold or used by producers, by county

(Thousand short tons)

County	1971		1972	
	Number of mines	Quantity	Number of mines	Quantity
Twiggs	6	1,246	6	1,301
Warren	--	--	2	149
Washington	17	1,452	17	1,490
Wilkinson	5	472	5	632
Other counties [1]	8	513	5	395
Total [2]	36	3,682	35	3,966

[1] Includes McDuffie, Richmond, and Sumter Counties.

[2] Data may not add to totals shown because of independent rounding.

Table 6.—Georgia: Kaolin sold or used by producers in 1972, by kind

(Short tons)

Kind	Quantity	Value
Air-float	788,023	$10,317,785
Calcined	132,895	10,196,168
Delaminated	186,230	8,574,354
Unprocessed	217,527	4,832,833
Waterwashed	2,641,768	86,574,679
Total	3,966,443	120,495,819

Table 7.—Georgia: Kaolin sold or used by producers, by use

(Short tons)

Use	1971	1972
Paper coating	1,370,468	1,435,199
Paper filling	801,084	758,723
Firebrick and block	260,073	92,897
Whiteware	140,555	162,596
Rubber	128,436	143,395
Fiberglass	105,614	130,625
Paint	99,239	127,460
Plastics	78,365	66,848
Other chemicals	38,391	28,795
Exports	512,106	681,973
Other uses [1]	147,974	337,932
Total	3,682,305	3,966,443

[1] Includes cement, catalysts, floor and wall tile, other pottery, other refractories, insecticides and fungicides, foundries and steelworks, and kiln furniture.

nessee Mining & Chemical Co.; and in Twiggs County by Lowes, Inc. Georgia's total output of fuller's earth in 1972 was 16% greater in quantity and 17% higher in value than in 1971.

Common clay and shale (used principally in manufacturing structural clay products and cement) was mined in 1972 by 14 companies from open pits in 12 counties. Among the leading producers of this type of clay were Burns Brick Co. in Bibb County; Chatahoochee Brick Co. in Floyd, Fulton, and Polk Counties; Cherokee Brick & Tile Co. in Bibb County; Griffin Pipe Products Co., (Operating unit of Amsted Industries, Inc.) in Floyd and Hancock Counties; Southern Cement Co., a division of Martin-Marietta Corp., in Fulton County; and Merry Brothers Brick & Tile Co. in Richmond County. Total tonnage and value of this material were 5% and 11% greater, respectively, than the corresponding figures for 1971.

Plans were announced by Tekology Corp., a subsidiary of Certain-Teed Products Corp., to spend $1.4 million in the construction of a new plant near Atlanta to manufacture low-cost building bricks, trade-named "Tekbricks", from mixtures of low-cost inorganic materials such as mine tailings, quarry wastes, and clay processing rejects.

The 1972 annual meeting of the Structural Clay Products Div. of the American Ceramic Society was held September 20-22 in Augusta, Ga. The program of the meeting, for which there were 156 registrants, included a number of plant tours and the presentation of 14 technical papers.

Feldspar.—The Feldspar Corp., treating pegmatite ore from the Monticello open-pit mine in Jasper County, produced feldspar in the form of a flotation concentrate. The product, totaling 9% more in quantity and 12% more in value than in 1971, was ground for use in glass and ceramics in at least 20 States, Canada, and Mexico. The research program of the Federal Bureau of Mines included an investigation of the feasibility and economics of the recovery of feldspar and glass sand from Georgia waste granite fines. A report concluding this project was being prepared.

Gypsum.—No production of crude gypsum was reported in Georgia, but three companies each operated one gypsum calcination plant (The Flintkote Co. and National Gypsum Co., both in Chatham County, and Georgia-Pacific Corp. in Glynn County), processing material from outside sources for use in plaster and wallboard, as cement retarder, as a filler, and for agricultural purposes. Total quantity and value of the calcined product amounted in 1972 to 702,000 tons and $13.0 million, respectively, both markedly higher than the corresponding figures in 1971.

Kyanite.—C-E Minerals, a division of Combustion Engineering, Inc., operated an open pit mine and a flotation plant to extract disseminated crystalline kyanite from a metamorphic quartzose rock formation at Graves Mountain, Lincoln County. Tonnage and total value, both slightly below the corresponding 1971 figures, marked the first breaks in either respect in almost a decade of successive annual increases. Most of the kyanite recovered was consumed, as usual, in the manufacture of special refractories for particular applications such as furnace linings for glassmaking plants and metal smelters. Refractory raw materials of the mullite type, in addition to those derived from kyanite, were produced by Babcock & Wilcox Co. and by Mulcoa, a division of Combustion Engineering, Inc., at plants in Richmond County and Sumter County, respectively. Both firms operated high-temperature sintering furnaces for this purpose, besides which Babcock & Wilco also produced fused material in an electric-arc process. The total output of these substances (collectively classified as synthetic mullite) was moderately more in tonnage than in the previous year, and the corresponding total value was substantially higher.

Mica.—Scrap and flake mica was mined in 1972 by Franklin Mineral Products Co. in Hart County and Thompson-Weinman & Co. in Cherokee County. Additionally, The Feldspar Corp. recovered a minor quantity as a byproduct from its feldspar flotation plant in Jasper County. Combined output from these operations was moderately greater in quantity and higher in total value than in 1971. Most of the mineral produced in 1972 was dry-ground in mills in Bartow and Hart Counties for use as a component in wallboard joint cement.

Perlite.—Armstrong Cork Co. expanded perlite from sources outside Georgia in one plant in Bibb County, mainly for use as lightweight aggregate and in special plaster products for noise abatement. Sales of perlite processed in Georgia amounted in 1972 to more than twice the tonnage and three times the total value recorded in 1971.

Sand and Gravel.—The 1972 output of sand and gravel was 3% greater in tonnage but 11% less in total value than that of 1971. An article in an industrial journal described the operations and equipment of a major new facility that will supply sand for concrete, mortar, and special uses to points as distant as 200 miles from the plant site in Taylor County.

Stone.—Stone, the State's mineral commodity next in importance after clays, accounted for 32% of the total value of Georgia's 1972 mineral production. The total tonnage of stone produced was 21% more than in 1971, and the total value was higher by 18%. Stone production was reported in 37 counties from 85 quarries operated by 46 private firms and two municipal agencies. Production of more than 1 million tons of stone was recorded in each of 13 counties, among which De Kalb, Douglas, Fulton, Gwinnett, and Jones

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[6] Trauffer, W. E. A new 385-TPH Georgia Sand Plant. Pit & Quarry, V. 65, No. 4, October 1972, pp. 117–120.

Table 8.—Georgia: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Cook	--	--	--	1	280	W
Evans	--	38	57	2	W	W
Fulton	1	W	W	1	2	4
Lee	--	--	--	1	152	W
Lowndes	1	224	168	--	--	--
Warren	--	--	--	1	60	90
Undistributed[1]	24	3,434	5,085	21	3,323	4,637
Total[2]	26	3,697	5,310	27	3,816	4,731

W Withheld to avoid disclosing individual company confidential data included with "Undistributed."

[1] Includes Bibb, Chatham, Crawford, De Kalb, Dougherty, Effingham, Greene, Long, Montgomery, Muscogee, Pike (1972), Richmond (1972), Sumter (1972), Taylor (1971), Terrell (1971), Thomas (1972), and Ware Counties.

[2] Data may not add to totals shown because of independent rounding.

Table 9.—Georgia: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,528	2,384	3,062	2,942
Fill	48	44	23	23
Other uses[1]	1,049	2,723	463	1,377
Total[2]	3,620	5,151	3,547	4,342
Gravel:				
Railroad ballast	--	--	60	90
Miscellaneous	W	W	8	17
Other uses[3]	78	159	202	281
Total[2]	78	159	270	387
Total sand and gravel[2]	3,697	5,310	3,816	4,729

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes blast, engine, filtration, foundry, glass molding, paving, and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes building, fill (1972), and other gravel.

Counties were in prominent positions. Stone with a total value in excess of $2 million was produced in each of 14 counties, with De Kalb, Fulton, Gwinnett, Jones, and Pickens Counties among the leaders. The State's 1972 output of crushed stone, all types, amounted to 37 million tons (21% higher than the 1971 total), of which 78% was shipped by truck, 20% by rail, and 2% by other means. Crushed stone capacity in the State was in the process of a major expansion. Vulcan Materials Co., without close competitors in terms of total tonnage (crushed granite, crushed limestone), was installing new crushing and screening equipment at a number of locations, and Georgia Marble Co. (crushed granite, crushed limestone, crushed marble) reavealed plans for the expenditure of $10.5 million on expansion and new construction of stone crushing and grinding facilities in Georgia and other southeastern States.

Crushed granite was produced from 29 quarries in 22 counties by 12 firms, among which Davidson Mineral Properties, Inc., Dixie Lime & Stone Co., Georgia Marble Co., Martin-Marietta Corp., and Vulcan Materials Co. were principal suppliers. Quantity and total value of this material, used chiefly as concrete and bitumen aggregate, roadstone, or railroad ballast, exceeded the corresponding 1971 figures by 23% and 30%, respectively, reaching all-time high points for the State.

Dimension granite was quarried at 30 locations in five counties by Bennie & Harvey Quarries, Inc.; Coggins Granite Industries, Inc.; Davidson Granite Co., Inc.; Georgia Marble Co.; Grimes Brothers Granite Co., Inc.; and 20 smaller producers, accounting in all for 24% more tonnage and 7% more total value than in 1971. Approximately three-fourths of this material (by weight) was used for monuments, and lesser quantities were marketed for curbing, construction material, cut or sawed stone, rough blocks, or rubble.

Crushed limestone or dolomite, produced by 10 private companies and one city highway department from 15 quarries in 11 counties, amounted to 14% more in quantity and 2% more in total value than in the previous year. This material was used as agricultural soil additive; cement-making raw material; concrete, bitumen, and macadam aggregates; riprap material; road metal; railroad ballast; and terrazzo stone. The five largest producers in 1972 were Dalton Rock Products Co.; Florida Rock Industries (formerly Georgia Rock Products Co.); L B I Quarries, Inc.; Medusa Corp.; and The Stone Man, Inc.

Crushed marble was produced in 1972 by two divisions of Georgia Marble Co. from two quarries, both in Pickens County. Output of this material, which was used chiefly for industrial filler, whiting, and terrazo stone, was substantially higher in tonnage and value than in 1971.

Dimension marble, with the highest unit-value rating of the various classifications of stone produced in the State, was quarried in 1972 only by Georgia Marble Co. at two locations in Pickens County. The year's output was markedly less in quantity and in total value than that of the previous year.

Crushed sandstone, with more than double the tonnage and total value recorded in 1971, was produced by The Feldspar

Table 10.—Georgia: Crushed granite sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971			1972		
	Quantity	Value		Quantity	Value	
		Total	Average per ton		Total	Average per ton
Bituminous aggregate	5,305	8,721	1.64	6,131	10,712	1.75
Concrete aggregate	7,383	11,884	1.61	8,854	14,972	1.69
Dense graded road base stone	2,834	4,624	1.63	5,698	9,681	1.70
Macadam aggregate	591	1,055	1.79	W	W	W
Surface treatment aggregate	1,305	2,036	1.56	1,353	2,397	1.77
Unspecified construction aggregate and roadstone	2,943	4,838	1.64	4,190	7,027	1.68
Railroad ballast	2,331	3,480	1.49	2,183	3,486	1.60
Riprap and jetty stone	179	333	1.86	592	1,094	1.85
Other uses [1]	1,294	1,878	1.45	668	1,150	1.72
Total [2]	24,167	38,849	1.61	29,668	50,520	1.70

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes stone used for agricultural purposes, uses not specified (1971), and macadam aggregate (1972).

[2] Data may not add to totals shown because of independent rounding.

Table 11.—Georgia: Dimension granite sold or used by producers, by county

County	1971				1972			
	Number of quarries	Thousand cubic feet	Short tons (equivalent)	Value (thousands)	Number of quarries	Thousand cubic feet	Short tons (equivalent)	Value (thousands)
De Kalb	4	549	46,001	W	3	356	29,359	W
Elbert	11	454	47,748	$2,217	11	611	57,797	$2,859
Oglethorpe	10	746	67,579	1,562	13	527	57,992	1,075
Undistributed [1]	3	327	27,190	2,463	3	882	88,801	2,726
Total	28	2,076	188,518	[2] 6,243	30	2,376	233,949	6,660

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Hancock and Madison Counties, and items indicated by symbol W.

[2] Data do not add to total shown because of independent rounding.

Table 12.—Georgia: Dimension granite sold or used by producers, by use

(Thousand cubic feet and thousand dollars)

Use	1971			1972		
	Quantity	Value		Quantity	Value	
		Total	Average per cubic foot		Total	Average per cubic foot
Rough:						
Agricultural	308	478	1.55	149	267	1.79
Construction	255	120	.47	W	W	W
Monumental	1,067	3,601	3.37	1,766	5,206	2.94
Dressed:						
Sawed stone	45	120	2.67	W	W	W
Curbing	291	W	W	W	W	W
Other uses [1]	110	1,924	17.49	461	1,187	2.57
Total	2,076	6,248	3.01	2,376	6,660	2.80

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes data for cut stone; 1971 data include data for dressed monumental stone, paving blocks and uses not specified. 1972 data include other rough stone, cut stone, dressed construction stone, and items indicated by symbol W.

Table 13.—Georgia: Crushed limestone [1] sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Bituminous aggregate	251	398	563	862
Concrete aggregate	676	1,041	744	1,322
Dense graded road base stone	1,338	1,923	599	875
Macadam aggregate	W	W	297	W
Surface treatment aggregate	223	418	396	590
Unspecified construction aggregate and roadstone	553	1,714	1,185	2,290
Cement	1,581	2,462	W	W
Terrazzo	--	--	50	750
Other uses [2]	746	2,708	2,346	4,163
Total [3]	5,368	10,664	6,180	10,853

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Limestone used generally to include dolomite.

[2] Includes agricultural limestone, fill (1972), railroad ballast, riprap and jetty stone, stone sand (1971), and items indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Corp. from one operation in Jasper County and by the Murray City Road Commission from one quarry in Murray County, chiefly for use in construction work and in cement manufacture. Dimension sandstone, representing sharp reductions in both tonnage and value from the previous year, was produced from one quarry in Pickens County by North Georgia Stone Co. and marketed as irregular-shaped building stone and as flagging for walks and terraces.

Slate was quarried in 1972 by GAF Corp. and by Georgia Lightweight Aggregate Co., each operating one facility, in Bartow and Polk Counties, respectively. The year's output, moderately above that of 1971 in quantity and value, was either crushed for use in the manufacture of roofing and low-density concrete aggregate or else was ground to flour to serve as industrial filler. Georgia Lightweight Aggregate Co. was in the process of doubling the capacity of its expanded-slate plant at Rockmart by the addition of a new 12-foot-diameter kiln and auxiliary handling and loading equipment scheduled to enter service in the spring of 1973.

Georgia Marble Co. received a $5.2 million contract to supply dimension marble over a 2-year period for the construction in Washington, D.C., of the James Madison Building, an addition to the Library of Congress and the 52d major structure in the Nation's Capital to display the beauty of Georgia marble. In Albany, N.Y., it was announced that Georgia will be the source of about 250,000 cubic feet of the dimension marble that will be used in the construction of the four State office buildings in the new South Mall complex.

Strontium.—Chemical Products Corp. processed celestite ore from Mexico in a Bartow County plant to obtain refined strontium compounds for consumption in electronic components and special-purpose glass formulations.

Talc.—Southern Talc Co. produced talcose material reported as soapstone from five underground mines in the Fort Mountain formation near Chatsworth, Murray County. The 1972 ouput was 13% below that of 1971, but the total value was 1% higher. The mineral was ground by the producer and used mostly (47% of the total) to coat roofing material; 22% was consumed as a filler for rubber products, 21% as a carrier and diluent for insecticides, and 9% as an asphalt filler, especially in preparations for the protective coating of oil and gas pipelines. A number of minor applications not separately identified accounted for the remaining 1%.

Georgia's talc-soapstone industry can boast of a venerable ancestry. Dr. Roy S. Dickens, Jr., a Georgia State University archeologist, has determined that as long ago as the pre-agricultural Archaic period, nomadic bands of still-unidentified Amerinds made occasional visits to soapstone outcrops in what is now Fulton County to obtain blocks of the easily carved material for fashioning into bowls, cooking pots, beads, tobacco pipes, and fishnet weights. Some of the pits dug in search of this useful mineral can still be seen along the top of Soapstone Ridge within the confines of present-day metropolitan Atlanta, perhaps 10,000 years after termination of Georgia's earliest mining operations.[7]

METALS

Bauxite.—American Cyanamid Co. reported production of bauxite from two open-pit mines in Sumter County. The year's production, markedly higher than in 1971, was consumed principally in the manufacture of high-alumina refractory grog and firebrick.

Iron Ore.—Three firms, operating open-pit mines in western Georgia (Dunbar & Layton Mining Co., Inc., and Luverne Mining Co., both in Stewart County, and Lumpkin Mining Co., in Quitman County), produced limonite, which was shipped to Alabama smelters for blending with ores from other sources. The State's total output of this type of iron ore in 1972 was substantially less than in 1971, following a similarly sharp decrease in the preceding year. Iron-oxide minerals classed as pigments (and hence reported separately from the metallurgical ores) were mined by New Riverside Ochre Co. at a surface mining operation in Bartow County. The 1972 output of this material, 30% above that of 1971 in both quantity and total value, was mostly consumed as coloring agent for paints, mortars, concrete, and clay products.

Rare-Earth Minerals.—Monazite concentrate (chiefly rare-earth phosphates and silicates) was one of the coproducts recovered by Humphreys Mining Co. in the process of dredging and milling titaniferous sands from Pleistocene river terraces in the Okefenokee Swamp area of Charlton County. Output of this concentrate, from which thorium and associated rare-earth metals were extracted for electrical, chemical, and medicinal applications, was 7% less in quantity and 12% lower in total value than in 1971.

Titanium.—Ilmenite concentrate (essentially ferrous titanate) was the most important product (with respect to both quantity and value) that was obtained by Humphreys Mining Co. from the processing of mineral-bearing sands in Charlton County. The year's ilmenite output, fractionally less than was recorded in 1971, was used as a raw material in the manufacture of pigments and ceramics.

Zirconium.—Zircon concentrate (zirconium silicate) was second in tonnage and value among the three valuable fractions separated by Humphreys Mining Co. from the heavy minerals contained in the Charlton County sands. The zircon produced in 1972, most of which was used in refractories, molding sand, and ceramics, amounted to 1% more than the tonnage recovered in 1971.

Humphreys Mining Co., specifically cited for its accomplishment in restoring more than 2 square miles of worked-over terrain at its Charlton County sand processing operation, received the first honor award ever granted by the State of Georgia for outstanding achievement in mined-land rehabilitation.

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[7] Wheeler, C. Ancient Indians Leave Mark. Atlanta Journal-Constitution, Aug. 13, 1972, pp. 1a, 6a.

MINERAL FUELS

Coal.—It was announced that Georgia, after a 9-year hiatus, will soon rejoin the roster of coal-producing States. A newly organized firm, Coal Man, Inc., completed preliminary steps toward commercial exploitation of a deposit of low-sulfur, high-Btu coal near Summerville, Chattooga County, in the Appalachian region of northwestern Georgia.

Peat.—Partially decomposed vegetable matter, accumulated in limestone sinks and classified as humus peat, was processed by two firms, Lake Park Moss Co., in Lowndes County, and Shep Peat Co. in Miller County. The 1972 output of this substance, sharply down from that of 1971, was dried and shredded for use in greenhouses as soil conditioner or root packing material for flowers and plants.

Table 14.—Principal producers

Commodity and company	Address	Type of activity	County
Barite, primary:			
New Riverside Ochre Co.	Box 387 Cartersville, Ga. 30120	Open pit mine	Bartow.
Paga Mining Co., Div. Thompson-Weinman & Co.	Box 130 Cartersville, Ga. 30120	Open pit mine and grinding mill.	Do.
Bauxite:			
American Cyanamid Co.	Berdan Ave. Wayne, N.J. 07470	Open pit mine and drying plant.	Sumter.
Cement, portland:			
Marquette Cement Manufacturing Co.	20 N. Wacker Dr. Chicago, Ill. 60606	Plant	Polk.
Martin-Marietta Corp. Southern Div.	18th Floor, Daniel Bldg. Birmingham, Ala. 35233	do	Fulton.
Medusa Cement Co. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	do	Houston.
Clays:			
Fuller's earth:			
Engelhard Minerals & Chemicals Corp.	Menlo Park Edison, N.J. 08817	Open pit mine	Decatur.
Georgia-Tennessee Mining & Chemical Co.	3379 Peachtree Rd. Atlanta, Ga. 30326	do	Jefferson.
Milwhite Co., Inc	Box 15038 Houston, Tex. 77020	do	Decatur.
Oil-Dri Corp. of Georgia.	Box 200-A Ochlocknee, Ga. 31773	do	Thomas.
Thor Mining Co.	Berkeley Springs W. Va. 25411	do	Do.
Waverly Mineral Products Co.	Box 106 Meigs, Ga. 31765	do	Do.
Kaolin:			
American Industrial Clay Co.	433 N. Broad St. Elizabeth, N.J. 07207	Open pit mines	McDuffie, Sumter, Washington.
Engelhard Minerals & Chemicals Corp.	Menlo Park Edison, N.J. 08817	do	Washington and Wilkinson.
Freeport Kaolin Co.	733 Third Ave New York, N.Y. 10017	Open pit mine	Twiggs.
Georgia Kaolin Co.	433 N. Broad St. Elizabeth, N.J. 07207	do	Do.
J. M. Huber Corp.	Thornall St. Edison, N.J. 08817	Open pit mines	Twiggs and Warren.
Thiele Kaolin Co.	Box 1056 Sandersville, Ga. 31082	do	Warren and Washington.
Common clay and shale:			
Burns Brick Co.	Box 4787 Macon, Ga. 31208	Open pit mine	Bibb.
Chattahoochee Brick Co.	3195 Brick Plant Rd., N.W. Atlanta, Ga. 30318	Open pit mines	Floyd, Fulton, Polk.
Cherokee Brick & Tile Co.	Box 4567 Macon, Ga. 31208	Open pit mine	Bibbs.
Griffin Pipe Products Co. Operating Unit AMSTED Industries Inc.	Drawer 548 Milledgeville, Ga. 31061	Open pit mines	Floyd and Hancock.
Martin Marietta Corp. Southern Div.	18th Floor, Daniel Bldg. Birmingham, Ala. 35233	Open pit mine	Fulton.
Merry Brothers Brick & Tile Co.	Box 1474 Augusta, Ga. 30903	do	Richmond.

Table 14.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Feldspar:			
The Feldspar Corp	Spruce Pine, N.C. 28777	Open pit mine and flotation plant.	Jasper.
Gypsum:			
The Flintkote Co	400 Westchester Ave. White Plains, N.Y. 10604	Calcination plant	Chatham.
Georgia-Pacific Corp. Gypsum Div.	Box 311 Portland, Oreg. 97207	do	Glynn.
National Gypsum Co	327 Delaware Ave. Buffalo, N.Y. 14202	do	Chatham.
Iron ore:			
Dunbar & Layton Mining Co.	Box 267 Lumpkin, Ga. 31815	Open pit mine	Stewart.
Lumpkin Mining Co	Box 284 Greenville, Ala. 36037	do	Quitman.
Luverne Mining Co	Box 409 Luverne, Ala. 36104	do	Stewart.
Iron oxide pigment materials:			
New Riverside Ochre Co	Box 387 Cartersville, Ga. 30120	do	Bartow.
Kyanite:			
Aluminum Silicates, Inc. Div. C-E Minerals, Inc., Div. Combustion Engineering, Inc.	433 South Gulph Rd. King of Prussia, Pa. 19406	Open pit mine and flotation plant.	Lincoln.
Mica:			
Franklin Mineral Products Co.	Box 0 Wilmington, Mass. 01887	Open pit mine and grinding mill.	Hart.
Thompson-Weinman & Co.	Box 130 Cartersville, Ga. 30120	do	Cherokee.
Peat:			
Lake Park Peat Moss Co	Lake Park, Ga. 31636	Open pit mine	Lowndes.
Shep Peat Co	Box 307 Colquitt, Ga. 31737	do	Miller.
Perlite, expanded:			
Armstrong Cork Co	1010 Concord St. Lancaster, Pa. 17604	Plant	Bibb.
Rare-earth minerals:			
Humphreys Mining Co., Div. Humphreys Engineering Co.	Box 8 Folkston, Ga. 31537	Dredge and plant	Charlton.
Sand and gravel:			
Atlanta Sand & Supply Co.	695 Forsyth Bldg. Atlanta, Ga. 30303	Open pit mine	Crawford.
Cornell-Young Co	Box 96, 4496 Mead Rd. Macon, Ga. 31206	do	Bibb.
Dawes Silica Mining Co	Box 470, Ochlocknee Rd. Thomasville, Ga. 31792	Open pit mines	Dougherty, Effingham, Long, Thomas.
Scruggs Concrete Co	Box 2065, 807 River St. Valdosta, Ga. 31601	Dredge	Cook.
Stone:			
Granite, crushed:			
Davidson Mineral Properties Inc.	Box 458, Rogers Lake Rd. Lithonia, Ga. 30058	Quarries and mills	De Kalb and Fulton.
Dixie Lime & Stone Co.	Box 910 Ocala, Fla. 32670	do	Clayton and Fayette.
Georgia Marble Co. Div. Jim Walter Corp.	11 Pryor St., SW. Atlanta, Ga. 30303	do	De Kalb and Douglas.
Martin-Marietta Corp. Southeastern Div.	Box 2479, 414 Fayetteville Raleigh, N.C. 27602	do	Jones and Richmond.
Vulcan Materials Co. Southeastern Div.	Box 7324-A, 1 Office Park Birmingham, Ala. 35223	do	Cobb, Douglas, Fulton, Gwinnett, Muscogee.
Granite, dimension:			
Bennie & Harvey Quarries Inc.	Box 958, Lower Heard St. Elberton, Ga. 30635	Quarry	Oglethorpe.
Coggins Granite Industries, Inc.	Box 250, Railroad St. Elberton, Ga. 30635	Quarries	Elbert and Madison.
Davidson Granite Co., Div. Davidson Mineral Properties, Inc.	Box 458, Rogers Lake Rd. Lithonia, Ga. 30058	Quarry	De Kalb.
Georgia Marble Co. Div. Jim Walter Corp.	11 Pryor St., SW. Atlanta, Ga. 30303	do	Madison.
Grimes Brothers Granite Co., Inc.	Box 916, Bowman Hwy. Elberton, Ga. 30635	do	Oglethorpe.

Table 14.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Limestone, crushed:			
Dalton Rock Products Co.	Box 1608 Dalton, Ga. 30720	Quarry and mill	Whitfield.
Florida Rock Industries, Inc.	Box 4667 Jacksonville, Fla. 32201	do	Early.
LBI Quarries, Inc.	Box 1067, 401 E. 1st. Ave. Rome, Ga. 31061	do	Floyd.
Medusa Cement Co. Div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	do	Houston.
The Stone Man, Inc.	Box 2098, 3814 Tenn. Ave. Chattanooga, Tenn. 37401	do	Walker.
Marble, crushed:			
Georgia Marble Co., Div. Jim Walter Corp.	11 Pryor St., SW. Atlanta, Ga. 30303	do	Pickens.
Marble dimension:			
Georgia Marble Co., Div. Jim Walter Corp.	do	Quarry and finishing plant.	Do.
Sandstone, crushed:			
Feldspar Corp.	Spruce Pine, N.C. 28777	Open pit mine and mill	Jasper.
Marquette Cement Manufacturing Co.	20 N. Wacker Dr. Chicago, Ill. 60606	Quarry and mill	Polk.
Sandstone, dimension:			
North Georgia Stone Co.	Whitestone, Ga. 30186	Quarry	Pickens.
Slate crushed:			
GAF Corp., Industrial Products Div.	140 West 51st. St. New York, N.Y. 10020	Quarry and mill	Bartow.
Georgia Lightweight Aggregate Co.	Box 188 Rockmart, Ga. 30125	Mine and mill	Polk.
Talc (soapstone)			
Southern Talc Co.	Box F Chatsworth, Ga. 30705	Underground mines and grinding mill.	Murray.
Titanium concentrate:			
Humphreys Mining Co., Div. Humphreys Engineering Co.	Box 8 Folkston, Ga. 31537	Dredge and plant	Charlton.
Zircon concentrate:			
Humphreys Mining Co., Div. Humphreys Engineering Co.	do	do	Do.

The Mineral Industry of Hawaii

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Hawaii Department of Land and Natural Resources for the collection of mineral data.

By Avery H. Reed [1]

Mineral output in Hawaii was about the same as in 1971. Total value was 5% below the 1969 record. The boom in construction had leveled off and was slow to resume the spectacular rise of the 1960's.

Hawaii was severely affected by the West Coast dock strike since the State is dependent on imports for almost every item essential to modern living.

Environmental controls were planned which could limit future growth. Air and water pollution, land and water use and many other environmental factors were studied.

Plans were made to investigate potential geothermal resources.

Table 1.—Mineral production in Hawaii [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland .... thousand short tons..	375	$10,196	402	$10,732
Masonry .... do....	11	431	13	384
Gem stones	NA	54	NA	57
Lime .... thousand short tons..	8	228	7	266
Pumice .... do....	289	779	379	762
Sand and gravel .... do....	836	1,967	609	1,893
Stone [2] .... do....	6,056	14,357	5,005	13,494
Value of items that cannot be disclosed:				
Clays, salt, and stone (dimension)	XX	r 95	XX	486
Total	XX	28,107	XX	28,074
Total 1967 constant dollars	XX	23,899	XX	p 23,355

p Preliminary. r Revised. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes dimension miscellaneous stone; included with value of items that cannot be disclosed.

Table 2.—Value of mineral production in Hawaii, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Hawaii	$2,155	$2,032	Stone, pumice.
Honolulu	22,976	22,721	Stone, cement, lime, clay, salt.
Kauai	766	741	Stone, sand and gravel, pumice.
Maui	2,210	2,579	Sand and gravel, stone, pumice, lime, gem stones.
Total	28,107	[1] 28,074	

[1] Data does not add to total shown because of independent rounding.

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[1] Physical scientist, Division of Nonmetallic Minerals.

Table 3.—Indicators of Hawaii business activity

	1971	1972 [p]	Change, percent
Total nonagricultural employment____thousands__	301.5	309.5	+2.6
Manufacturing employment____do____	24.8	25.2	+1.6
Contract construction____do____	23.4	23.1	−1.3
Other nonagricultural employment [1]____do____	252.9	261.6	+3.4
Personal income:			
Total____millions__	$3,694	$3,991	+8.0
Per capita____	$4,738	$4,995	+5.4
Construction activity:			
Number of private and public residential units authorized____	12,241	16,083	+31.4
Value of authorized nonresidential construction____millions__	$103.4	$101.5	−1.8
Mineral production value____do____	$28.1	$28.1	--

[p] Preliminary.

[1] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government.

Sources: Survey of Current Business, Construction Review, Employment and Earnings and Annual Report on the Labor Force, and U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Kaiser Cement & Gypsum Corp. operated a cement plant near Nanakuli, and Hawaiian Cement Corp. operated a plant at Barbers Point, both on Oahu, in Honolulu County. Shipments of portland cement increased 7% to 402,100 tons, 2% above the 1970 record. Shipments of masonry cement were a record 12,780 tons, 16% above the 1971 record. The portland cement was consumed for ready-mix concrete (78%), concrete products (13%), building materials (5%), and other uses (4%).

Raw materials used in portland cement included 229,900 tons of limestone and 73,440 tons of basalt which were mined on Oahu; 40,210 tons of silica sand from Australia and New Zealand; and 17,780 tons of gypsum from Mexico.

The two plants consumed 301,000 barrels of fuel oil and purchased 50 million kilowatt-hours of electric energy.

Kaiser completed a new kiln which added 282,000 tons to plant capacity. Hawaiian Cement completed a new kiln which added 291,000 tons to plant capacity.

Clays.—Pacific Clay Corp. mined common clay at Waimanalo, Oahu, in Honolulu County, or use in making face brick.

Gem Stones.—Value of coral collected was estimated at $57,000. The value of retail sales of coral jewelry was estimated at more than $3 million. Coral is present in waters around Hawaii in gold, pink, bamboo, and black colors.

Lime.—GasprO Ltd. and Hawaiian Commercial & Sugar Co., Ltd. produced lime in Honolulu and Maui Counties for sugar refining, steel furnaces, mason's lime, sewage treatment, and water purification. Output decreased 22% to 6,608 tons and was 32% below the 1966 record.

Pumice and Volcanic Cinder.—Seventeen operators produced pumice and volcanic cinder at 17 mines for concrete, roads, landscaping, and fill. Output increased 31% to 379,100 tons and was 8% above the 1970 record. Leading counties were Hawaii and Maui. Leading producers were Volcanite, Ltd., Hilo Coast Processing Co., and Laupahoehoe Sugar Co. Among the States, Hawaii ranked fourth in production of pumice.

Salt.—Tanaka Hawaiian Salt recovered a small quantity of solar salt near Honolulu.

Sand and Gravel.—Eleven operators mines sand and gravel at 11 mines in Maui and Kauai Counties for concrete and roads, fill, and other uses. Output declined 27% to 609,100 tons. Leading producers were HC&D, Ltd., Maui Concrete & Aggregates, Inc., and Louis K. Rego Trucking.

Stone.—Ten operators crushed traprock at 14 quarries for concrete and roads, cement, fill, and other uses. Output declined 21% to 3,596,000 tons, 24% below 1970. Leading counties were Honolulu and Hawaii. Leading producers were Lone Star Industries, HC&D, Ltd., and Pacific Concrete & Rock Co., Ltd.

Eight operators crushed limestone at eight quarries for cement, concrete and roads, fill, lime, landscaping, and other uses. Output increased 4% to 1,229,000 tons and was 2% above 1970. The leading county was Honolulu. Leading producers were Pacific Concrete & Rock Co., Ltd., Hawaiian Cement Corp., and Kaiser Cement & Gypsum Corp.

Four operators crushed miscellaneous stone at five quarries for concrete and roads and for other uses. Output declined 47% and was 53% below 1970. Leading counties were Honolulu and Hawaii. Leading producers were the Federal Government and Yamada Sons, Inc.

Joe's Moss Rock, Inc., R&R Moss Rock, and James Kuwana quarried a small quantity of dimension miscellaneous stone for construction use.

Total crushed stone production was 5,005,000 tons valued at $13,494,000, a decrease of 17%, and 21% below 1970.

Vermiculite.—Vermiculite of Hawaii, Inc. exfoliated vermiculite imported from Montana at a plant on Oahu.

MINERAL FUELS

Hawaiian Independent Refinery, Inc. dedicated its new 30,000-barrel-per-day refinery at Campbell Industrial Park, Oahu. Products include aviation gasoline, marine and diesel fuel, and low-sulfur residual fuel oil.

Conoco-Dillingham Oil Co. announced plans to construct a 50,000-barrel-per-day refinery on Oahu. This would increase the total capacity for Hawaii to 115,000 barrels per day. The Standard Oil Co. of California refinery capacity is 35,000 barrels per day.

Table 4.—Principal producers

Commodity and company	Address	Type of activity	Island
Cement:			
Hawaiian Cement Corp	1600 Kapiolani Blvd. Suite 1200 Honolulu, Hawaii 96814	Dry process portland cement plant.	Oahu.
Kaiser Cement & Gypsum Corp.	Permanente Rd. Permanente, Calif. 95014	Wet process portland cement plant.	Do.
Clays: Pacific Clay Corp	547 Halekauwila St. Honolulu, Hawaii 96813	Open pit mine	Do.
Lime:			
GasprO, Ltd	P.O. Box 2454 Honolulu, Hawaii 96804	Rotary kiln and continuous hydrator.	Do.
Hawaiian Commercial & Sugar Co. Ltd.	Puunene, Hawaii 96784	do	Maui.
Pumice and volcanic cinder:			
Fong Construction Co., Ltd	237 Dairy Rd. Kahului, Hawaii 96732	Open pit mine	Do.
HC&D, Ltd	P.O. Box 190 Honolulu, Hawaii 96810	do	Molokai.
James Kuwana	P.O. Box 406 Pahoa, Hawaii 96778	do	Hawaii.
Hilo Coast Processing Co.	Pepeekeo, Hawaii 96783	do	Do.
Laupahoehoe Sugar Co	Papaaloa, Hawaii 96780	do	Do.
Volcanite, Ltd	8282 Fort St. Honolulu, Hawaii 96813	do	Do.
Salt: Tanaka Hawaiian Salt	968 D Akepo Lane Honolulu, Hawaii 96817	Solar evaporation	Oahu.
Sand and gravel:			
Concrete Industries, Inc	P.O. Box 86 Puunene, Hawaii 96784	Open pit mine	Maui.
HC&D, Ltd	P.O. Box 190 Honolulu, Hawaii 96810	do	Molokai.
Kekaha Sugar Co., Ltd	Kekaha, Hawaii 96752	do	Kauai.
Maui Concrete & Aggregates, Inc.	8 Central Ave. Wailuku, Hawaii 96793	do	Maui.
Louis K. Rego Trucking	Lihue, Hawaii 96766	do	Kauai.
Stone:			
Concrete Industries, Inc	P.O. Box 86 Puunene, Hawaii 96784	Open quarry	Maui.
James W. Glover, Ltd	P.O. Box 275 Hilo, Hawaii 96720	do	Hawaii.
Grove Farm Co., Inc	Puhi Rural Station Puhi, Hawaii 96766	do	Kauai.
Hawaiian Bitumuls & Paving Co., Ltd.	P.O. Box 2240 Honolulu, Hawaii 96804	do	Oahu.
Hawaiian Cement Corp	1600 Kapiolani Blvd. Suite 1200 Honolulu, Hawaii 96814	do	Do.
HC&D, Ltd	P.O. Box 190 Honolulu, Hawaii 96810	do	Do.
Kaiser Cement & Gypsum Corp.	Permanente Rd. Permanente, Calif. 95014	do	Do.
Lone Star Industries, Pacific Region.	400 Alabama St. San Francisco, Calif. 94110	do	Do.
Pacific Concrete & Rock Co., Ltd.	2344 Pahounui Dr. Honolulu, Hawaii 96819	do	Molokai, Oahu.
Vermiculite (exfoliated): Vermiculite of Hawaii, Inc.	842-A Mapunapuna St. Honolulu, Hawaii 96819	Exfoliating plant	Oahu.

The Mineral Industry of Idaho

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Idaho Bureau of Mines and Geology for collecting information on all minerals except fuels.

By William C. Butterman [1]

The value of Idaho's mineral production in 1972 was 106 million, 5% below its value in 1971. Silver was again the leading mineral commodity, accounting for 23% of the State's mineral revenues, in spite of a sharp drop in output due to a disastrous fire at the Sunshine mine. As in the past, the next most valuable commodities, were lead, zinc, sand and gravel and phosphate rock. The first three of these accounted for 40% of the total production value. The quantity of lead and zinc produced declined by 8% and 14%, respectively; however, owing to higher prices, the value of lead produced remained essentially the same as in 1971, and the value of zinc output dropped only 5%. Sand and gravel was down 32% in quantity and 10% in value. The combined value of nine other commodities listed individually in table 1 decreased 9% but the value of the remaining items increased 10% compared with values in 1971.

Mining companies in the Coeur d'Alene district funded a year-long study by the University of Idaho on revegetation of ground areas covered by mine wastes. A variety of grasses, shrubs, and trees were tested. It was planned to follow the study with a large-scale demonstration project in Shoshone County, which would be a cooperative effort of the sponsoring mines and the University.[2] The University began

Table 1.—Mineral production in Idaho [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Antimony ore and concentrate short tons, antimony content	857	$817	345	$303
Clays thousand short tons	W	W	57	415
Copper (recoverable content of ores, etc.) short tons	3,776	3,927	2,942	3,013
Gem stones	NA	100	NA	105
Gold (recoverable content of ores, etc.) troy ounces	3,596	148	2,884	169
Lead (recoverable content of ores, etc.) short tons	66,610	18,384	61,407	18,459
Mercury 76-pound flasks	1,057	309	161	35
Peat thousand short tons	W	W	--	--
Sand and gravel do	11,279	11,437	7,696	10,294
Silver (recoverable content of ores, etc.) thousand troy ounces	19,140	29,590	14,251	24,012
Stone thousand short tons	4,149	6,118	3,094	7,042
Tungsten ore and concentrate (60% WO_3 basis) short tons	25	66	W	W
Zinc (recoverable content of ores, etc.) do	45,078	14,515	38,647	13,720
Value of items that cannot be disclosed: Cement (portland and masonry), fluorspar (1971), garnet, iron ore, lime, perlite, pumice, phosphate rock, vanadium, and values indicated by symbol W	XX	26,869	XX	28,639
Total	XX	112,280	XX	106,206
Total 1967 constant dollars	XX	95,472	XX	p 88,353

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data, included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

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[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

[2] The Wallace Miner. "Mining Corporations, Working Through Greater Shoshone, Inc., Doing Part To Revegetate Area." V. 66; No. 34, Sept. 7, 1972, p. 2.

Table 2.—Value of mineral production in Idaho, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Ada	W	$1,080	Sand and gravel, clays, stone.
Adams	W	303	Copper, sand and gravel, silver.
Bannock	$4,399	4,588	Cement, stone, sand and gravel.
Bear Lake	324	W	Sand and gravel.
Benewah	W	W	Garnet, sand and gravel, stone.
Bingham	W	W	Phosphate rock, sand and gravel.
Blaine	10	W	Lead, silver, gold.
Boise	77	--	
Bonner	W	W	Sand and gravel, silver, gold, copper, lead.
Bonneville	1,281	1,722	Lime, sand and gravel, stone, pumice.
Boundary	90	W	Sand and gravel.
Camas	W	W	Do.
Canyon	1,655	W	Sand and gravel, lime.
Caribou	14,204	16,997	Phosphate rock, vanadium, stone, sand and gravel.
Cassia	147	90	Stone, sand and gravel, clays.
Clark	58	92	Iron ore, stone, sand and gravel, lead, silver, clays.
Clearwater	W	W	Stone, sand and gravel.
Custer	1,344	775	Lead, silver, zinc, copper, gold, tungsten.
Elmore	W	W	Sand and gravel, clays.
Franklin	566	W	Stone, sand and gravel.
Fremont	W	W	Sand and gravel.
Gem	W	W	Do.
Gooding	W	--	
Idaho	W	W	Sand and gravel, stone, gold.
Jefferson	--	336	Sand and gravel.
Jerome	33	--	
Kootenai	W	W	Sand and gravel, stone.
Latah	W	1,713	Sand and gravel, stone, clays.
Lemhi	175	80	Copper, sand and gravel, silver, lead, gold.
Lewis	--	155	Stone.
Lincoln	W	W	Sand and gravel.
Madison	W	W	Sand and gravel, stone.
Minidoka	W	W	Lime, sand and gravel, clays.
Nez Perce	W	776	Stone, sand and gravel.
Oneida	232	235	Sand and gravel, pumice, perlite.
Owyhee	--	W	Sand and gravel, gold.
Payette	W	W	Sand and gravel.
Power	12	W	Sand and gravel, stone.
Shoshone	66,073	59,232	Silver, lead, zinc, copper, stone, antimony, gold.
Teton	292	W	Sand and gravel.
Twin Falls	W	W	Sand and gravel, lime.
Washington	W	252	Stone, sand and gravel, mercury, iron ore.
Undistributed [2]	21,312	17,775	
Total [3]	112,280	106,206	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Butte and Valley Counties are not included because no production was reported in 1971 or 1972.

[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

another study, sponsored by the Federal Bureau of Mines, designed to identify the conditions and mechanisms involved in the formation of pollutants in the Coeur d'Alene River. The results were to be used in formulating pollution abatement procedures for the river. Hecla Mining Co. began relocation of about 0.6 mile of the South Fork of the Coeur d'Alene River to provide space for a new tailings pond at its Lucky Friday mine near Mullan.

Early in the year, American Smelting & Refining Company (Asarco), as part of a reappraisal of its activities in Idaho's Silver Belt, suspended development work on the Consolidated Silver Corp. property, near the Sunshine mine, and cutback on development of the Coeur Project near the Galena mine. Coeur d'Alene Mines Corp., owner of the Coeur property, contested the action in a suit against Asarco that was still pending at yearend.

The Sunshine mine, the country's leading producer of siilver, was closed for more than 7 months on orders of State and Federal authorities after a disastrous fire on May 2 in which 91 men died. The closure orders were lifted on December 8 and preparation for production began immediately; production commenced in early January 1973. Early in the year, before the fire, stoping had begun on the Chester vein on the 5,400 foot level, where the ore averaged more than 50 ounces of silver per ton over a width of about 4 feet.

The Bunker Hill Co., according to its 1972 annual report, became the first industrial concern in the United States, and possibly the world, with commercial facilities to remove mercury from byproduct sulfuric acid. The company began using the new process on byproduct acid from its lead-zinc smelter, and reportedly was able to reduce the mercury content to

Table 3.—Indicators of Idaho business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force...thousands..	305.3	315.7	+3.4
Unemployment...do....	16.9	17.8	+5.3
Employment: (nonagricultural)			
Construction...do....	11.2	11.5	+2.7
Mining...do....	3.4	3.0	−11.8
Manufacturing...do....	41.2	43.2	+4.8
Government...do....	51.3	53.7	+4.7
All other...do....	110.0	117.2	+6.5
Personal Income:			
Total...millions..	$2,511	$2,748	+9.4
Per capita...	$3,409	$3,635	+6.6
Construction activity:			
New housing units authorized...	5,078	4,378	−13.9
Nonresidential building permits issued...thousands..	$25.0	$42.3	+69.2
State highway commission: Value of contracts awarded...millions..	$34.7	e $45.0	+29.7
Cement shipments to and within Idaho...thousand short tons..	440	415	−5.7
Farm marketing receipts...millions..	$741.8	$859.1	+15.8
Mineral production value...do....	$112.3	$106.2	−5.4

e Estimated. p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; U.S. Bureau of Mines; and Idaho Economic Indicators.

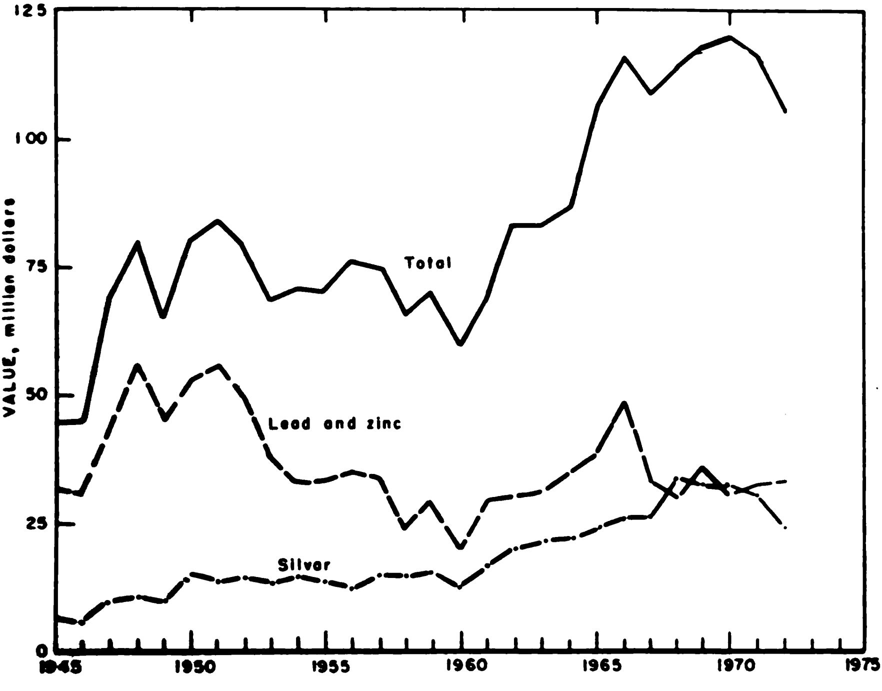

Figure 1.—Value of silver, lead and zinc, and total value of mineral production in Idaho.

less than one part per million (ppm) from levels as high as 100 ppm. The company also began engineering work on a leach-electrowinning facility for the recovery of copper from matte, spiess, and residues from the zinc and lead plant, and contracted with Incad Corp. to have flue dust processed for recovery of contained metals.

Questions over the future of mining in the White Clouds area of Custer County and, in particular, over Asarco's proposed open-cast molybdenum mine, continued. A provisional report by a task force from several Federal and State agencies was released in April. It recommended, in part, that plans for mining molybdenum be delayed until a national need has been demonstrated and that should a national need be demonstrated, alternate sites for mining molybdenum or other minerals should be considered first. A joint study of the area by the Federal Bureau of Mines and the U.S. Geological Survey, which was expected to provide important data for a final report, continued throughout the year, with results scheduled for release in 1973. The White Clouds area became part of the approximately 1,170-square-mile Sawtooth National Recreation Area, established by Public Law 92–400, August 22, 1972. Under this Act, Federal lands in the recreation area were withdrawn from all forms of location, entry, and patent; existing claims could not be patented; and the Secretary of Agriculture was authorized to acquire the mineral interests in lands within the area when deemed necessary for the purposes of the act.

Late in the year, the Federal Bureau of

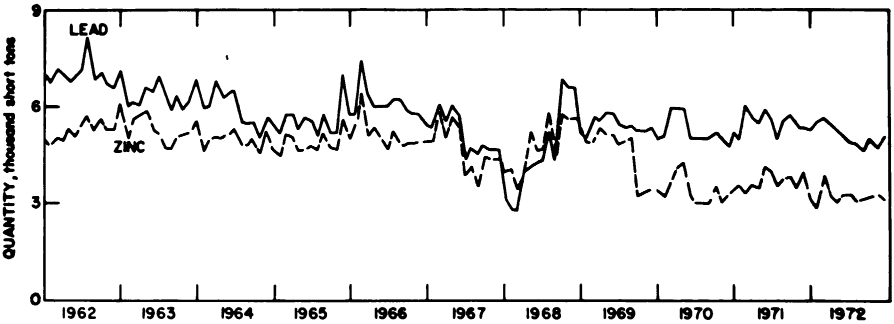

Figure 2.—Mine production of lead and zinc in Idaho, by month, in terms of recoverable metals.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries: Fatal	Number of injuries: Nonfatal	Injury rates per million man-hours: Frequency	Injury rates per million man-hours: Severity
1971:								
Metal	2,255	251	565	4,510	6	352	79.38	10,881
Nonmetal	456	217	99	813	1	11	14.76	7,509
Sand and gravel	686	157	108	887	--	24	27.05	3,574
Stone	298	196	58	476	--	14	29.42	456
Total	3,695	225	830	6,686	7	401	61.03	8,759
1972:[1]								
Metal	1,975	247	488	3,905	94	271	93.46	148,107
Nonmetal	475	229	108	895	1	19	22.35	10,527
Sand and gravel	315	144	46	374	--	4	10.71	104
Stone	220	207	46	368	--	8	21.72	1,461
Total	[2]2,990	230	688	5,542	95	302	71.63	106,167

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

[2] Data does not add to total shown because of independent rounding.

Mines announced plans to let contracts for a pilot plant to test its citrate process, designed to remove sulfur dioxide from dilute streams of smelter gas and yield either elemental sulfur, sulfuric acid, or concentrated sulfur dioxide as the end product. The plant was to be built at Bunker Hill's lead-zinc smelter at Kellogg.

Employment and Injuries.—Data on employment, earnings, worktime, and injuries in the mineral industry are shown in tables 3 and 4.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—Production of antimony ore and concentrate fell 60% to 345 tons of contained antimony. The antimony was a byproduct of silver ores and was recovered at Sunshine Mining Co.'s electrolytic antimony plant at Big Creek, near Wallace, Shoshone County. The drop in output was ascribed to the loss of production from the Sunshine unit mine area, following the May 2 fire.

Copper.—The output of copper dropped 22% to 2,942 tons, and value declined about the same percentage to $3.0 million. The Hanna Mining Co. and Pom Corp. (Ann Arbor, Mich.) announced a joint venture to explore and possibly develop a copper-cobalt prospect southwest of Salmon, in Lemhi County. Early in the year, Sunshine Mining Co. drew up detailed specifications for a proposed new silver-copper refinery. It was reported that at least eight companies, including Humble Oil and Refining Co., were examining the eastern Coeur d'Alene district for possible large disseminated copper and silver deposits. Silver King Mines, Inc., Salt

Table 5.—Idaho: Mine production (recoverable) of gold, silver, copper, lead and zinc, by county

County	Mines producing [1]		Material sold or treated [2] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
Total:							
1970	50	1	1,539,408	3,128	$113,826	19,114,829	$33,848,922
1971	26	--	1,646,661	3,596	148,336	19,139,575	29,589,785
1972:							
Adams	1	--	17,000	--	--	8,750	14,744
Clark	1	--	166	--	--	323	544
Custer	3	--	92,136	430	25,198	147,984	249,353
Idaho	--	1	--	2	117	--	--
Lemhi	3	--	1,200	6	352	10,594	17,851
Owyhee	--	1	--	3	176	--	--
Shoshone	9	--	1,283,154	2,408	141,109	14,078,444	23,722,176
Undistributed [3]	2	--	479	35	2,051	4,630	7,801
Total	19	2	1,394,135	2,884	169,003	14,250,725	24,012,469

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
Total:							
1970	3,612	$4,167,785	61,211	$19,121,110	41,052	$12,577,513	$69,829,156
1971	3,776	3,926,728	66,610	18,384,444	45,078	14,515,036	66,564,329
1972:							
Adams	213	217,764	--	--	--	--	232,508
Clark	--	--	31	9,427	--	--	9,971
Custer	53	54,503	855	257,118	527	186,925	773,097
Idaho	--	--	--	--	--	--	117
Lemhi	31	31,990	2	517	--	--	50,710
Owyhee	--	--	--	--	--	--	176
Shoshone	2,644	2,707,683	60,510	18,189,259	38,120	13,532,724	58,292,951
Undistributed [3]	1	632	9	2,703	--	--	13,187
Total	2,942	3,012,572	61,407	18,459,024	38,647	13,719,649	59,372,717

[1] Operations at old mill or miscellaneous cleanups not counted as producing mines.
[2] Does not include gravel washed.
[3] Includes Blaine and Bonner Counties combined to avoid disclosing individual company confidential data.

Table 6.—Idaho: Mine production of gold, silver, copper, lead, and zinc in 1972, by class of ore or other source material, in terms of recoverable metals

Source	Number of mines	Material sold or treated (thousand short tons)	Gold (troy ounces)	Silver (thousand troy ounces)	Copper (thousand pounds)	Lead (thousand pounds)	Zinc (thousand pounds)
Lode ore:							
Silver[1]	6	434	1,047	8,690	4,143	2,008	1,106
Copper	4	20	66	19	558	--	--
Lead	5	257	1,319	3,264	537	50,475	4,547
Lead-zinc	4	683	447	2,278	646	70,332	71,641
Total	19	1,394	2,879	14,251	5,884	122,815	77,294
Placer	2	--	5	--	--	--	--
Grand total	21	1,394	2,884	14,251	5,884	122,815	77,294

[1] Includes silver recovered by Sunshine Mining Co. from mine dump. Material was used as sand fill and to make concrete needed in repair to mine following fire.

Table 7.—Idaho: Mine production of gold, silver, copper, lead, and zinc in 1972 by type of material processed and method of recovery, in terms of recoverable metals

Type of material processed and method of recovery	Gold (troy ounces)	Silver (thousand troy ounces)	Copper (thousand pounds)	Lead (thousand pounds)	Zinc (thousand pounds)
Lode:					
Smelting of concentrates from ore	2,838	14,235	5,820	122,730	77,294
Direct smelting of ore	41	16	64	84	--
Total	2,879	14,251	5,884	[1] 122,815	77,294
Placer	5	--	--	--	--
Grand total	2,884	14,251	5,884	122,815	77,294

[1] Data does not add to total shown because of independent rounding.

Lake City, dedicated its new Copper Cliff mill, in the Seven Devils district, Adams County. Existing capacity was 300 tons per day, which the company planned to double when mine production warranted it.

Gold.—The output of gold fell 20% to 2,884 troy ounces, but owing to the sharp rise in free market gold prices, the value rose 14%, to $169,000. Most of the gold was a byproduct of base metal sulfide ores from the Coeur d'Alene district.

Iron Ore.—Shipments of iron ore rose 250% in quantity and 130% in value. All production came from two localities, the Iron Mountain magnetite deposit in Washington County, mined by C & W Sand & Gravel Co., and a deposit in Clark County, mined by E. J. Wilson and Sons.

Lead.—The production of lead declined 8% to 61,407 tons, but its value remained nearly unchanged at $18.5 million. Idaho remained second among lead-producing States, and four of its mines—Bunker Hill, Lucky Friday, Star-Morning and Dayrock—were among the top 25 lead-producing mines in the Nation. Bunker Hill Co. contracted to supply J. R. Simplot Co. of Pocatello with 35,000 tons per year of sulfuric acid, a byproduct of Bunker Hill's lead-zinc smelter at Kellogg.

Mercury.—Idaho's only sizeable mercury mine, the Idaho-Almaden, in Washington County, ceased operations early in the year because of a continued decline in the market price of mercury. Thus, 1972 production fell to 161 flasks, from 1,057 flasks in 1971. The average sales price fell to $217 per flask, down from $292 in 1971, $408 in 1970, and $505 in 1969. The mine's management estimated that $400 per flask would be required to sustain operations.

Silver.—The output of silver dropped 26% to 14.3 million troy ounces, and the value declined 19% to $24 million. Most of the approximately 5 million-ounce drop was due to loss of production from the Sunshine mine, which remained closed for more than 7 months following the May 2 fire. Five mines accounted for over 96% of the State's silver production. The Sunshine mine yielded 2.8 million ounces before shutdown. Production at the Galena mine was 4.2 million ounces; the Lucky Friday mine, 2.8 million ounces; the Crescent mine, 1.5 million ounces; and the Bunker Hill and Star-Morning mines together, 2.3 million ounces.

American Silver Mining Co. and Coeur d'Alene Mines Corp. planned to unitize adjoining claims in the Coeur d'Alene district to facilitate deep development work. Midnite Mines, Inc., acquired a block of 344 mining claims, southeast of Mullan, Shoshone County. Geological reconnaissance revealed silver-bearing siderite and quartz veins. Further exploration was planned.

The Bunker Hill Co. resumed exploration by diamond drilling of the Magna vein containing silver, copper, and lead on the Princeton property, 7 miles east of Mullan, Shoshone County.

Ore reported to average 40 ounces of silver per ton was mined on a small scale from the surface at the Bullion Lode mine, east of Riggins, Idaho County.

Tungsten.—Small amounts of tungsten ore were produced at the Tungsten Jim mine in Custer County and at the Golden Gate mine in Valley County.

Vanadium.—Production of vanadium was up 17% in 1972. The element was recovered as the pentoxide from byproduct ferrophosphorous slag by the Kerr-McGee Corp. at its phosphate fertilizer plant in Soda Springs, Caribou County. Colorado Central Mines, Inc., took part in investigations in southeastern Idaho where an estimated 50 to 75 million tons of vanadiferous shale contains 0.90% to 0.98% V_20_5. Participants in the studies will evaluate mining techniques and costs.

Zinc.—The production of zinc was down 14% to 38,647 tons, valued at $13.7 million. Two mines, the Bunker Hill and the Star-Morning, yielded most of Idaho's zinc. In the Bunker Hill mine at Kellogg, mining of new zinc ore zones in the upper levels of the mine began in the second half of the year.

NONMETALS

Cement.—Portland and masonry cements were manufactured by Idaho Portland Cement Co. at Inkom, Bannock County. Production and value of portland cement were up 29% and 38%, respectively. Production and value of masonry cement remained about the same as in 1971. Consumption, mainly supplied by shipments into Idaho, was 418,488 short tons of portland cement and 1,749 short tons of masonry cement.

Clays.—The quantity of clays of all types sold or used by producers in Idaho rose, but value fell sharply as production shifted away from high value clays and toward common clays and shale. Fire clay was mined by A. P. Green Refractories Co. in Latah County, kaolin by J. R. Simplot Co. in Latah County, and bentonite by E. J. Wilson & Sons in Clark County.

Fluorspar.—No fluorspar was mined in Idaho in 1972. However, exploration for fluorspar continued in Custer and Lemhi Counties. N L Industries, Inc. explored the Bay Horse Creek porperty, southwest of Challis; Ozark Mahoning Co. conducted drilling on a property on Garden Creek, west of Challis, and Seaforth Minerals and Ore Co. drilled the Meyers Cove property in Lemhi County.

Garnet.—Abrasive-grade garnet was produced by two companies, Emerald Creek Garnet Milling Co., and Idaho Garnet Abrasive Co. from deposits near Fernwood, Benewah County. Production was essentially the same as in 1971, but value decreased 8%.

Gem Stones.—The value of gem stone materials collected in Idaho was estimated at $105,000, up 5% from the value in 1971. Collection, mainly by individuals, continued to be centered around the Star garnet digging area near Fernwood, Benewah County, and at the precious opal digging site northeast of Spencer, Clark County.

Lime.—Two sugar companies produced lime for beet-sugar processing and water purification. Utah-Idaho Sugar Co. produced lime in Bonneville County, and the Amalgamated Sugar Co. in Canyon, Minidoka, and Twin Falls Counties. Output decreased 4% in 1972.

Perlite.—Production of crude perlite from the open pit operation of Oneida Perlite Corp. near Malad City, Oneida County, was down 37%, but value decreased only 4%. Crude perlite was expanded at the company's plant at Malad City. Expanded perlite was used mainly as a filter aid and as a lightweight aggregate in concrete and plaster.

Phosphate Rock.—Production of marketable phosphate rock was up 15%, but value remained about the same. Four companies mined phosphate rock in Idaho in 1972. J. R. Simplot Co. operated the Gay mine, in Bingham County, and the Conda mine, in Caribou County; Monsanto Co. operated the Henry mine in Caribou County; Stauffer Chemical Co. obtained rock from the Wooley Valley deposit in Caribou County, and at mid-year, Agricultural Products Corp. reactivated the Dry Valley mine in Caribou County, which had been closed in 1969 by Mountain Fuel Supply Co.

Pumice.—Production of pumice from three quarries in Bonneville and Oneida Counties increased 111%. Generally, pumice was used in road construction (including ice control and maintenance) and as an additive and aggregate in concrete.

Sand and Gravel.—Output of sand and gravel was down 32% to 7.7 million tons, and value declined 10% to $10.2 million. Production was reported from 35 of the 44 counties in the State.

Stone.—Production of stone dropped 25% in 1972, but value rose 15%. Forty-four quarries in 20 counties yielded 3.1 million tons, valued at $7.0 million. Clearwater County led the State in production. Granite and traprock were produced mainly, followed by quartzite and limestone, and small amounts of quartz and marble.

Table 8.—Idaho: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	--	--	6	55
Building	591	1,219	554	1,064
Fill	50	47	W	W
Glass	--	--	80	740
Paving	W	W	182	164
Other uses [1]	213	316	288	263
Total [2]	853	1,582	1,111	2,286
Gravel:				
Building	1,452	1,786	643	1,262
Fill	211	108	658	483
Paving	1,726	2,641	1,329	1,788
Other uses [3]	163	303	83	78
Total [2]	3,550	4,839	2,714	3,610
Government-and-contractor operations:				
Sand:				
Building	--	--	1	2
Fill	61	50	25	16
Paving	2,653	2,476	373	761
Other uses	7	4	1	1
Total [2]	2,721	2,530	400	780
Gravel:				
Building	136	105	160	107
Fill	673	254	322	95
Paving	3,222	1,991	2,817	3,276
Other uses	126	135	172	140
Total [2]	4,155	2,485	3,471	3,618
Total sand and gravel [2]	11,279	11,437	7,696	10,294

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes railroad ballast (1971) and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1971), and miscellaneous gravel.

Table 9.—Principal producers

Commodity and company	Address	Type of activity	County
METALS			
Antimony: Sunshine Mining Co	Kellogg, Idaho 83837	Mine and plant	Shoshone.
Copper:			
American Smelting & Refining Co	Wallace, Idaho 83873	Mine and mill	Do.
Sunshine Mining Co	Kellogg, Idaho 83837	do	Do.
Gold:			
Hecla Mining Co	Wallace, Idaho 83873	do	Do.
Iron Ore: C & W Sand & Gravel Co	Route 1 Weiser, Idaho 83672	Mine	Washington.
Lead:			
Bunker Hill Co	Kellogg, Idaho 83837	Mine, mill, smelter.	Do.
Canyon Silver Mines, Inc	Wallace, Idaho 83873	Mine	Do.
Clayton Silver Mines	do	Mine and mill	Custer.
Day Mines, Inc	do	do	Shoshone.
Hecla Mining Co	do	do	Do.
Mercury: El Paso Natural Gas Co	P.O. Box 1492 El Paso, Tex. 79999 (Weiser, Idaho 83672)	Mine and plant	Washington.
Silver:			
American Smelting & Refining Co	Wallace, Idaho 83873	Mine and mill	Shoshone.
Bunker Hill Co	Kellogg, Idaho 83837	do	Do.
Clayton Silver Mines	Wallace, Idaho 83873	do	Custer.
Day Mines, Inc	do	do	Shoshone.
Hecla Mining Co	do	do	Do.
Sunshine Mining Co	Kellogg, Idaho 83837	do	Do.
Tungsten:			
Salmon River Scheelite Corp	Clayton, Idaho 83227	Mine and plant	Custer.
Vanadium: Kerr-McGee Corp.[1]	Soda Springs, Idaho 83276	Plant	Caribou.
Zinc:			
Bunker Hill Co	Kellogg, Idaho 83837	Mine, mill, smelter.	Do.
Clayton Silver Mines	Wallace, Idaho 83873	Mine and mill	Custer.
Day Mines, Inc	do	do	Caribou.
Hecla Mining Co	do	do	Do.
NONMETALS			
Cement: Idaho Portland Cement Co	Inkom, Idaho 83245	Plant	Bannock.
Clays:			
Burley Brick & Sand Co	P.O. Box 497 Burley, Idaho 83318	Pit and plant	Cassia.
A. P. Green Refractories Co	Troy, Idaho 83871	do	Latah.
Pullman Brick Co., Inc	7901 Warm Springs Ave. Boise, Idaho 83706	do	Ada and Elmore.
J. R. Simplot	P.O. Box 647 Bovill, Idaho 83806	do	Latah.
Garnet:			
Emerald Creek Garnet Milling Co	Box 192 Kellogg, Idaho 83837	Mine and plant	Benewah.
Idaho Garnet Abrasive Co	P.O. Box 1080 Kellogg, Idaho 83827	do	Do.
Peat: Idaho Peat, Inc	Downey, Idaho 83234	Bog	Bannock.
Perlite (crude and exported):			
Oneida Perlite Corp	P.O. Box 162 Malad City, Idaho 83252	Pit and plant	Oneida.
Phosphate Rock:			
Agricultural Products Corp	Box 37 Conda, Idaho 83230	Mine and plant	Caribou.
Monsanto Co	Soda Springs, Idaho 83276	do	Do.
J. R. Simplot Co	Box 912 Pocatello, Idaho 83201	Mine	Bingham.
	Conda, Idaho 83230	Mine and plant	Caribou.
Stauffer Chemical Co	Box 160, Montpelier, Idaho 83245	Mine	Do.
Pumice:			
Amcor Inc	P.O. Box 229 Ogden, Utah 84402	do	Bonneville.
Hess Pumice Products	P.O. Box 209 Malad City, Idaho 83252	Mine and plant	Oneida.
Producer's Pumice	2743 East Lincoln Idaho Falls, Idaho 83401	Mine	Bonneville.
Sand and gravel:			
Curtis Construction Co	1401 North Fancher Rd. Spokane, Wash. 99206	Stationary plant	Clearwater.
Bannock Paving Co	Pocatello, Idaho 83201	2-stationary plants.	Oneida.
Idaho Concrete Pipe Co., Inc	222 Caldwell Blvd. Nampa, Idaho 83651	Stationary plant	Canyon.
Ready-to-Pour Concrete Co	P. O. Box 1221 Idaho Falls, Idaho 83401	4-stationary and 2 dredge plants.	Bonneville, Bingham and Twin Falls.
Seubert Excavators Inc	Cottonwood, Idaho 83522	2 portable plants	Latah.

See footnote at end of table.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Stone:			
Carl Carbon, Inc	Box 5158 N. Central Sta. Spokane, Wash. 99205	Quarry and plant.	Latah.
DeAtley Corp	Box 648 Lewiston, Idaho 83501	----do	Nez Perce.
Dworshak Dam Construction	Box 1422 Orofino, Idaho 83544	----do	Clearwater.
Grant Construction Co	P.O. Box 168 Hayden Lake, Idaho 83835	Quarries and plants.	Kootenai and Shoshone.
Idaho Portland Cement Co	Inkom, Idaho 83245	Pit and plant	Bannock.
Monsanto Chemical Co	800 North Lindberg Ave. St. Louis, Mo. 63166	----do	Caribou.

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[1] Recovered from byproduct ferrophosphorus.

The Mineral Industry of Illinois

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Illinois State Geological Survey, under a memorandum of understanding for collecting information on all minerals except mineral fuels.

By Grace N. Broderick [1]

The mineral production of Illinois in 1972 was valued at $769.7 million, an increase of 9.8% over the record high of $700.9 million set in 1971. Mineral fuels continued to account for the major part of the total mineral value; nonmetals comprised nearly 29%; and metals accounted for the remainder. Nationally, Illinois led in the production of fluorspar, ranked second in output of stone and peat, fourth in sand and gravel production, and fourth in output of coal. Coal remained the leading commodity in mineral value, accounting for $402.5 million or 52% of the State total.

Output of bituminous coal from Illinois in 1972 was 65.5 million tons, a 12% increase in quantity above that of 1971; total value of coal production increased 26% over that of the previous year. Production of crude petroleum was 34.9 million barrels, 4.2 million barrels less than in 1971, and, in value, accounted for $121.0 million, 15.7% of the total mineral output of the State. Marketed production of natural gas increased 140% both in quantity and value. Production of liquefied petroleum gases increased, but natural gasoline de-

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[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Illinois [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Cement:				
Portland .... thousand short tons	1,425	$25,975	1,571	$33,124
Masonry .... do	73	2,336	80	2,483
Clays .... do	1,788	4,294	[2] 1,716	[2] 3,314
Coal (bituminous) .... do	58,402	318,878	65,523	402,481
Fluorspar .... short tons	138,051	9,883	132,405	9,961
Gem stones	NA	[r] 2	NA	2
Lead (recoverable content of ores, etc.) .... short tons	1,238	342	1,335	401
Natural gas .... million cubic feet	498	[r] 139	1,194	334
Peat .... thousand short tons	72	W	74	985
Petroleum (crude) .... thousand 42-gallon barrels	39,084	135,621	34,874	121,013
Sand and gravel .... thousand short tons	45,364	59,397	[3] 39,929	[3] 61,696
Stone [4] .... do	61,991	106,084	[3] 56,260	[3] 94,225
Zinc (recoverable content of ores, etc.) .... short tons	12,706	4,091	11,378	4,039
Value of items that cannot be disclosed; Fuller's earth (1972), lime, natural gas liquids, silver, stone (dimension), tripoli, and values indicated by the symbol W	XX	[r] 33,828	XX	35,729
Total	XX	[r] 700,870	XX	769,737
Total 1967 constant dollars	XX	595,950	XX	[p] 640,344

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fuller's earth; included with "Value of items that cannot be disclosed."

[3] Data not directly comparable with that of previous years because of changes in coverage.

[4] Excludes dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Illinois, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	$3,907	$3,056	Stone, lime, sand and gravel, petroleum.
Alexander	248	W	Tripoli, sand and gravel.
Bond	W	W	Sand and gravel, petroleum, clays.
Boone	W	626	Stone, sand and gravel.
Brown	63	26	Sand and gravel, petroleum, clays.
Bureau	613	432	Sand and gravel.
Calhoun	W	W	Stone.
Carroll	407	W	Stone, sand and gravel.
Champaign	780	737	Sand and gravel, stone.
Christian	W	W	Coal, petroleum, stone.
Clark [2]	W	W	Petroleum, stone, sand and gravel.
Clay	W	W	Petroleum, stone.
Clinton	2,765	W	Petroleum, stone, sand and gravel.
Coles	W	2,353	Stone, petroleum, sand and gravel, natural gas.
Cook	45,632	42,800	Stone, lime, sand and gravel, clays, peat.
Crawford	7,072	6,407	Petroleum, sand and gravel.
Cumberland [2]	W	W	Sand and gravel, stone, petroleum.
De Kalb	W	W	Stone, sand and gravel.
De Witt	W	W	Petroleum, sand and gravel.
Douglas	22,671	27,353	Natural gas liquids, coal, stone, petroleum.
Du Page	4,008	3,553	Stone, sand and gravel.
Edgar	357	390	Petroleum.
Edwards	2,040	1,898	Do.
Effingham	1,252	1,054	Do.
Fayette	16,829	13,643	Petroleum, stone, sand and gravel, clays.
Ford	W	W	Sand and gravel, stone.
Franklin	45,081	48,078	Coal, petroleum.
Fulton	24,858	W	Coal, sand and gravel.
Gallatin	14,280	19,011	Coal, petroleum, sand and gravel.
Greene	W	W	Stone.
Grundy	3,568	W	Sand and gravel, clays.
Hamilton	4,357	4,028	Petroleum.
Hancock	862	805	Stone.
Hardin	14,635	15,346	Fluorspar, stone, zinc, lead, silver.
Henderson	507	522	Stone, sand and gravel.
Henry	W	W	Do.
Iroquois	W	W	Sand and gravel, stone.
Jackson	1,211	W	Coal, stone, sand and gravel.
Jasper	2,882	2,382	Petroleum.
Jefferson	46,656	62,485	Coal, petroleum.
Jersey	211	190	Stone.
Jo Daviess	2,785	3,075	Zinc, sand and gravel, stone, lead, silver.
Johnson	W	W	Stone, coal.
Kane	8,403	6,373	Sand and gravel, stone, peat.
Kankakee	8,424	6,924	Coal, stone, clays, sand and gravel.
Kendall	W	W	Stone, sand and gravel.
Knox	W	W	Coal, stone, clays.
Lake	W	W	Sand and gravel, peat, stone.
La Salle	W	W	Sand and gravel, cement, clays, stone.
Lawrence	16,239	W	Petroleum, sand and gravel, stone.
Lee	W	W	Cement, stone, sand and gravel.
Livingston	4,565	W	Stone, clays, sand and gravel.
Logan	W	W	Sand and gravel, stone.
McDonough	W	813	Stone, petroleum, clays, sand and gravel.
McHenry	W	W	Sand and gravel, stone.
McLean	W	W	Sand and gravel.
Macon	577	W	Sand and gravel, stone, petroleum.
Macoupin	W	W	Coal, stone, petroleum.
Madison	W	W	Stone, petroleum, sand and gravel.
Marion	W	W	Petroleum, stone.
Marshall	W	W	Sand and gravel.
Mason	W	W	Do.
Massac	W	W	Cement, stone, sand and gravel.
Menard	W	W	Stone.
Mercer	450	W	Coal, stone.
Monroe	W	W	Stone.
Montgomery	W	12,556	Coal, stone, petroleum.
Morgan	W	--	
Moultrie	W	W	Sand and gravel, petroleum, stone.
Ogle	W	W	Sand and gravel, stone.
Peoria	15,500	16,124	Coal, stone, sand and gravel.
Perry	34,037	54,502	Coal, petroleum.
Pike	W	W	Stone, sand and gravel.
Pope	W	W	Coal, sand and gravel.
Pulaski	W	W	Clays, stone.
Putnam	W	W	Sand and gravel.
Randolph	W	W	Coal, stone, sand and gravel, petroleum.
Richland	4,650	3,815	Petroleum.
Rock Island	W	W	Stone, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Illinois, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
St. Clair	$31,722	$41,961	Coal, stone, sand and gravel, petroleum.
Saline	[r] 19,122	19,406	Coal, petroleum, natural gas.
Sangamon	1,467	W	Sand and gravel, petroleum, stone.
Schuyler	W	W	Sand and gravel, stone.
Scott	618	W	Stone, clays, sand and gravel.
Shelby	528	W	Sand and gravel, stone, petroleum.
Stark	3,351	W	Coal, sand and gravel.
Stephenson	W	532	Stone, sand and gravel.
Tazewell	W	W	Sand and gravel, clays.
Union	W	W	Stone, sand and gravel.
Vermilion	W	2,058	Stone, sand and gravel, coal, clays.
Wabash	W	W	Petroleum, sand and gravel.
Warren	W	W	Stone.
Washington	W	W	Petroleum, stone.
Wayne	14,397	12,403	Petroleum.
White	19,465	16,522	Petroleum, sand and gravel.
Whiteside	1,360	2,340	Stone, peat, sand and gravel.
Will	11,496	10,813	Stone, sand and gravel.
Williamson	[r] 26,635	30,030	Coal, petroleum, natural gas.
Winnebago	2,258	3,575	Stone, sand and gravel.
Woodford	W	1,173	Sand and gravel.
Undistributed [3]	205,073	267,610	
Total [4]	[r] 700,870	769,737	

[r] Revised.

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Cass and Piatt Counties are not listed because no production was reported.

[2] Value of petroleum production in Cumberland County is included with Clark County because actual source of production cannot be identified.

[3] Includes some sand and gravel, stone, and petroleum that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Illinois business activity

	1971	1972 [p]	Change, percent
Labor force and employment, annual average:			
Total labor force ..... thousands..	5,027.8	5,004.3	−0.5
Unemployment ..... do....	239.0	226.0	−5.4
Employment (nonagricultural):			
Manufacturing ..... do....	1,266.8	1,269.5	+.2
Construction ..... do....	186.0	180.3	−3.1
Mining ..... do....	22.5	23.4	+4.0
Transportation and public utilities ..... do....	283.4	280.3	−1.1
Wholesale and retail trade ..... do....	945.7	940.4	−.6
Finance, insurance, and real estate ..... do....	238.6	239.0	+.2
Government ..... do....	648.6	654.8	+1.0
Personal income:			
Total ..... millions..	$53,400	$57,675	+8.0
Per capita	$4,775	$5,126	+7.4
Construction activity:			
Value of authorized nonresidential private construction ..... millions..	$969.9	$899.4	−7.3
Number of private and public residential permits issued	84,091	75,380	−10.4
Portland cement shipments to and within Illinois thousand short tons..	3,913	3,606	−7.8
Mineral production value ..... millions..	[r] $700.9	$769.7	+9.8

[p] Preliminary. [r] Revised.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

creased. Production of peat increased both in quantity and value.

Among the nonmetallic mineral commodities, stone ranked first in value, followed by sand and gravel and cement. Combined output of sand and gravel and stone accounted for 20% of the State's total mineral value in 1972. Illinois supplied about 53% of the total domestic output of fluorspar. Other nonmetallic minerals produced in Illinois were clays, gem stones, lime, and tripoli.

Lead and zinc were produced as primary products from mines in Jo Daviess County (Northern Illinois district) and as byproducts of fluorspar mining in Hardin County

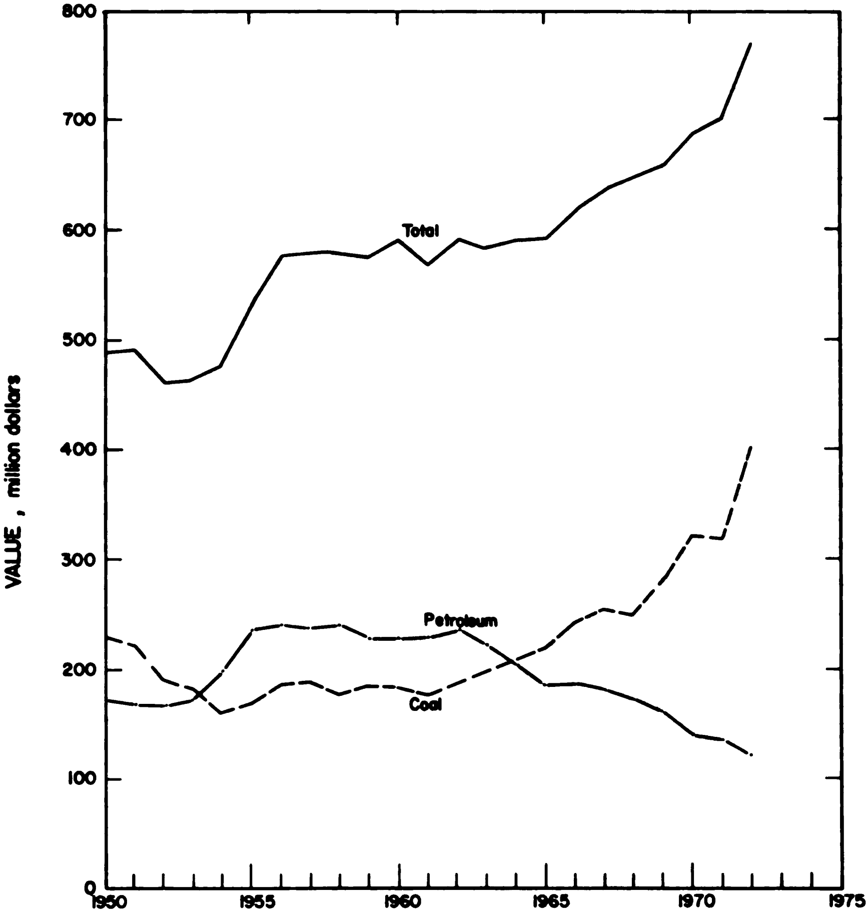

Figure 1.—Value of coal, petroleum, and total value of mineral production in Illinois.

(Southern Illinois district). In terms of recoverable metal, lead output increased 7.8% in quantity and 17.3% in total value; zinc production decreased 10.5% in quantity and 1.3% in total value. Small amounts of silver were recovered in smelter operations.

In 1972, Illinois ranked 10th in value of mineral production among the States.

Employment.—Preliminary data for 1972, and final data for 1971 compiled by the Federal Bureau of Mines for employment and injuries in the mineral industries are shown in table 4.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	9,430	256	2,411	18,824	15	828	44.78	NA
Metal	58	236	14	109	--	4	36.58	274
Nonmetal	1,039	263	273	2,216	7	91	44.23	21,258
Sand and gravel	1,744	229	399	3,424	--	47	13.73	396
Stone	3,673	265	974	8,167	4	203	25.35	3,857
Total	15,944	255	4,071	[1] 32,741	26	1,173	36.62	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	50	249	13	102	--	4	39.33	1,691
Nonmetal	900	267	240	1,948	--	101	51.97	1,335
Sand and gravel	1,355	210	284	2,421	--	39	16.11	1,388
Stone	2,860	261	747	6,261	1	140	22.52	3,198
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data does not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Illinois continued to rank fourth in the Nation in the production of bituminous coal with an output of 65.5 million tons valued at $402.5 million, which represented an increase of 12% in tonnage and 26% in value from 1971 levels. Value of bituminous coal production accounted for 52% of the State's total mineral value in 1972.

Coal prices, after more than a decade of relative stability, have risen substantially in the past 4 years. The average value per ton (f.o.b. mine) for Illinois coal in 1967 was $3.88 compared with $6.14 in 1972, a total increase of 58.2%. However, when adjusted for inflation the real increase was only 27.3%.

The utility market, which is by far the largest single outlet for Illinois coal, has grown from 51.3% of the total Illinois coal market in 1957 to 79.1% in 1972. In the matter of retaining this market, the inability of Illinois coal to meet the stringent air pollution regulations governing sulfur oxides emissions from powerplants in Illinois and adjacent States is of considerable concern.

Shipments of coal from Illinois to all destinations amounted to 67.2 million tons. Of this tonnage, over 47% went to Iowa, Indiana, Kentucky, Minnesota, Missouri, and Wisconsin. Of its own coal production, Illinois retained 31.3 million tons or nearly 48%. Shipments of western coals to Illinois increased 31% from 3.7 million tons in 1971 to 4.8 million tons in 1972.

Of the 42.0 million tons of coal shipped for consumption in Illinois, electric utilities consumed 76.8%, coke and gas plants 7.7%, retail dealers 3.4%, and all others 12.1%. This coal was shipped by rail (58.5%), by water (26.5%), and by truck (15.0%). Shipments transported from the mine to point of use by conveyor or tram are included with truck shipments.

Production in Illinois in 1972, excluding mines producing less than 1,000 short tons annually, was reported from 59 mines, 4 less than were operating in 1971, in 22 of the State's 102 counties. Major producing counties, in order of decreasing tonnage, were Perry, St. Clair, Jefferson, Franklin, Christian, Fulton, Williamson, Randolph, Peoria, Saline, Gallatin, Montgomery, Macoupin, Knox, and Douglas. A little more than half of the coal produced in the State (51.6%) was from strip mines.

Mine closures during the year were as follows:

Freeman Coal Mining Corp.'s Orient No. 5 underground coal mine closed on December 15, 1972. The mine, located 4 miles east of Benton, Franklin County, opened

Table 5.—Illinois: Bituminous coal production, by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total[1]	
Christian	1	--	1	4,693	--	4,693	W
Douglas	1	--	1	1,239	--	1,239	W
Franklin	4	--	4	7,270	--	7,270	$45,764
Fulton	--	4	4	--	4,375	4,375	27,708
Gallatin	2	1	3	1,746	642	2,388	16,417
Jackson	--	2	2	--	142	142	853
Jefferson	3	1	4	6,428	945	7,373	59,130
Johnson	--	1	1	--	4	4	W
Kankakee	--	1	1	--	519	519	W
Knox	--	1	1	--	1,519	1,519	W
Macoupin	1	--	1	1,983	--	1,983	W
Mercer	1	1	2	30	11	40	W
Montgomery	1	--	1	1,991	--	1,991	W
Peoria	--	3	3	--	2,515	2,515	14,395
Perry	--	4	4	--	11,177	11,177	54,432
Pope	--	1	1	--	3	3	W
Randolph	1	2	3	823	3,041	3,864	22,769
St. Clair	3	1	4	2,438	4,997	7,435	37,652
Saline	3	5	8	1,237	1,213	2,450	18,043
Stark	--	1	1	--	502	502	W
Vermilion	1	--	1	16	--	16	W
Williamson	4	4	8	1,826	2,197	4,023	29,425
Undistributed	--	--	--	--	--	--	75,892
Total[1]	26	33	59	31,721	33,802	65,523	402,481

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Data may not add to totals shown because of independent rounding.

in November 1960 and had produced approximately 14.8 million tons of salable coal. Approximately 240 men were employed at the mine when it was closed.

Peabody Coal Co., which closed its Midwest strip mine in St. Clair County in January 1971, closed its Midwest Highwall No. 3 underground mine, located near Millstadt in St. Clair County, on November 30, 1972. The underground mine was opened in 1970 and had produced 1,476,070 tons of salable coal during its operating life.

Sahara Coal Co.'s No. 5 mine closed on June 23, 1972, after 34 years of operation. The mine, located near Harrisburg, Saline County, had produced 17,677,851 tons of salable coal. The company's No. 16 mine, also in Saline County, was closed in 1971.

The Barbara Kay Coal Co.'s mine at Paulton, Williamson County, closed permanently on February 9, 1972. Reportedly the mine closed because of new Federal laws governing coal mining. The mine employed 35 miners and annual production in 1971 was 90,375 tons. In 1972, 13,388 tons of coal was produced prior to closing. The mine had produced 13,539,537 tons of coal in its 35 years of operation.

The one strip mine that closed in 1972 was Midland Coal Co.'s Elm Pit No. 2, which closed in May.

United Electric Coal Co.'s Cuba No. 9 mine in Fulton County was worked out as of May 1971.

Production was expected to begin in 1973 at a new coal mine developed 1 mile north of Murdock in Douglas County. The facility, Zeigler No. 5 mine, is owned and operated by the Zeigler Coal Co. and will employ approximately 300 men. One unit train, composed of 62 coal cars having a capacity of 100 tons each, will run from the mine 5 days per week. Zeigler Coal Co. also has begun a program of accelerated development of a 40,000,000-ton reserve of coal located east of the present mining area of Zeigler No. 4 mine, near Johnston City, Williamson County. The expansion extends partly into Franklin County.

Consolidation Coal Co.'s Burning Star No. 4 strip mine near Jamestown, under development in 1972, was to have been operating by August 1973. The mine, once it is in full swing, was to employ more than 100 men.

Midland Coal Co. was planning a new processing plant to be located near Victoria in Knox County. Construction of the plant was expected to be completed in 2

Table 6.—Illinois: Shipments of bituminous coal for consumption, by district of origin and consumer use

(Thousand short tons)

	District of origin [1]									Total
	1	3 and 6	4	7 and 8	9	10	11	15	19	
1968:										
Electric utilities	--	12	127	12	1,885	25,539	646	--	--	28,221
Coke and gas plants	--	196	--	1,678	--	1,200	--	--	--	3,069
Retail dealers	--	--	11	1,231	665	1,362	48	--	--	3,312
All others	--	41	--	484	258	7,618	462	--	--	8,863
Total	--	249	138	3,400	2,808	35,719	1,151	--	--	43,465
1969:										
Electric utilities	--	4	--	--	3,063	26,622	656	--	48	30,393
Coke and gas plants	--	99	--	2,076	--	1,538	--	--	--	3,713
Retail dealers	--	--	14	1,287	587	1,141	48	--	--	3,077
All others	22	45	--	356	254	7,102	282	--	--	8,061
Total	22	148	14	3,719	3,904	36,403	986	--	48	45,244
1970:										
Electric utilities	--	--	--	1	2,175	25,688	514	--	1,075	29,453
Coke and gas plants	--	1	--	2,069	--	1,618	--	--	--	3,688
Retail dealers	--	--	5	1,329	237	1,015	2	3	--	2,591
All others	13	29	--	447	188	5,657	245	--	--	6,579
Total	13	30	5	3,846	2,600	33,978	761	3	1,075	42,311
1971:										
Electric utilities	--	--	--	43	1,431	22,204	W	--	W	27,930
Coke and gas plants	W	--	--	1,847	--	1,424	--	--	W	3,347
Retail dealers	--	--	4	1,082	59	723	W	--	W	1,871
All others	W	2	--	687	92	4,189	W	--	W	5,141
Total	27	2	4	3,659	1,582	28,540	825	--	[2]3,650	38,289
1972:										
Electric utilities	--	--	--	200	1,586	25,329	393	--	[3]4,786	32,294
Coke and gas plants	--	--	--	1,955	--	1,288	--	--	--	3,243
Retail dealers	--	--	2	759	13	630	9	2	--	1,415
All others	--	14	--	809	118	4,084	51	--	--	5,076
Total	--	14	2	3,723	1,717	31,331	453	2	[3]4,786	42,028

W Withheld to avoid disclosing individual company confidential data; included in "Total."

[1] States or portion of States represented by each district are as follows: District 1—Maryland, eastern Pennsylvania, and eastern West Virginia; 3 and 6—northern West Virginia; 4—Ohio; 7 and 8—eastern Kentucky, Virginia, southern West Virginia, and north-central Tennessee; 9—western Kentucky; 10—Illinois; 11—Indiana; 14—Arkansas and Oklahoma (Haskell, Le Flore and Sequoyah Counties); 15—Kansas, Missouri, and remaining Oklahoma Counties; 19—Idaho and Wyoming; 22—Montana.

[2] Includes shipments from districts 14, 15, 19, and 22.

[3] Includes district 22.

years. A new dragline will make it possible to strip mine 450 acres annually. In 1972, Midland strip mined 335 acres in Victoria Township.

The Institute of Gas Technology (IGT) has reported more than 100 hours of continuous operation of its Hygas pilot plant in Chicago; 72 to 75 tons per day of Montana lignite was converted into sulfur-free gas with a heat content of 900 to 1,000 Btu per cubic foot, and at pipeline pressure of 1,000 pounds per square inch. An IGT spokesman said that all essential parts of the plant were in integrated operation.

IGT also was working on an independent system that would use waste char from the Hygas plant, together with steam and iron oxide, to produce the hydrogen needed in low-grade coal gasification. An $18.16 million contract has been let to IGT by the Office of Coal Research (OCR) for process development of the steam-iron oxide system. OCR will provide two-thirds of the cost of the 25-month contract and the American Gas Association (AGA) will provide the rest.

Coke.—Production of coke in 1972 was 2.085 million tons, a decrease of 2.8% from the 2.144 million tons produced in 1971. There were four plants operating at yearend. Ninety-eight percent of the coke distributed by the producing companies was used in their own blast furnaces. Illinois coke plants carbonized 3.312 million tons of coal, of which 38% came from Illinois, 34.8% from Kentucky, 21.9% from West Virginia, 3.2% from Arkansas, 1.9% from Pennsylvania, and less than 1% from Virginia and Oklahoma.

About 186,000 tons of coke breeze was recovered at the producing plants, a decrease of 1.6% from 1971. Other byproducts of coke-oven operations in the State included coke-oven gas, ammonia, tar, crude light oil, and light oil derivatives.

Natural Gas.—Marketed production of natural gas in 1972 was 1,194 million cubic feet valued at $334,000, a considerable increase over the 498 million cubic feet valued at $139,000 of the previous year.

According to estimates of the AGA, proved natural gas reserves in Illinois on December 31, 1972, were 545,361 million cubic feet, an increase of 46,408 million cubic feet.

To help alleviate the growing shortage of natural gas, a number of synthetic natural gas (SNG) plants were either under construction or being planned in Illinois. One of these SNG plants was being built near Morris (Minooka), Grundy County, by Northern Illinois Gas Co. The plant was scheduled to have an initial capacity of 166 million cubic feet per day and was expected to begin operation in early 1974. At full capacity, the plant is expected to produce 250 million cubic feet per day. Under a 15-year contract with MAPCO, Inc., 21,800 barrels per day of natural-gas-liquids feedstock will be supplied, and through MAPCO's subsidiary, San Juan Oil Co., an additional 27,200 barrels per day will be delivered on a best-effort basis. MAPCO will lay 101 miles of 8-inch line from Farmington, Ill., to deliver natural-gas liquids to the plant site and will lay 17 miles of 42-inch line to provide storage for 60,000 barrels of feedstock mixtures.

Another SNG plant will be built near Joliet in Will County by Peoples Gas, Light & Coke Co. The facility will process about 33,000 barrels (1.39 million gallons) of liquid hydrocarbons daily. Feedstock will be naphtha and gas condensate from refineries in the area and supply contracts have been signed with Union Oil Co. of California and American Oil Co. (Amoco). The plant will have a capacity of 160 million cubic feet per day, which is equivalent to 18% of the company's current annual deliveries in Chicago. Construction was to begin in mid-1973 and was expected to be completed in time for the 1974–75 heating season.

The Illinois Napgas Co., a subsidiary of Trunkline Gas Co., which in turn is a wholly—owned subsidiary of Panhandle Eastern Pipe Line Co., plans to construct an SNG plant, tentatively to be located near the point where Explorer Pipeline and Panhandle Eastern's main transmission line cross near the town of Blue Mound in Macon County. Negotiations were underway to obtain feed stock supplies (naphtha or other petroleum liquids) from foreign sources at the rate of 30,000 barrels per day. Proposed capacity of the plant is 47 billion cubic feet per year or roughly 130 million cubic feet per day.

Continental Oil Co. is planning an SNG plant in northern Illinois with a capacity of 125 million cubic feet per day and requiring 33,000 barrels per day of naphtha or liquefied petroleum gas (LPG). It is expected to be operating by early 1975. Output of the plant will be sold under a 20-year contract to Northern Illinois Gas Co.

Central Illinois Light Co. has completed a feasibility study for an SNG plant near Peoria, Peoria County. The plant would use naphtha feedstock. It would process 12,000 barrels per day and would have a capacity of 60 million cubic feet per day.

The first natural gas fuel cell ever placed in a single-family home to convert gas energy into electric power was installed in an Aurora, Ill. home by northern Illinois Gas Co. on January 14, 1972.

A $13 million plant for liquefying 10 million cubic feet per day of natural gas is being constructed by Peoples Gas, Light & Coke Co. at the site of the company's underground storage facility near Mahomet, Champaign County. The plant will be capable of storing 2 billion cubic feet of liquefied natural gas (LNG) and regasifying it at the rate of 200 million cubic feet per day.

Two former gasfields of about 1,100 acres in Williamson County were being developed for storage by the Central Illinois Public Service (CIPS). CIPS gets its gas from Texas Eastern Transmission Co., which has limited the amount of gas it sells customers because of the gas shortage.

Natural Gas Liquids.—Production of natural gas liquids increased 1% in quantity and 5.7% in value over those of 1971. Proved reserves of natural gas liquids, according to the AGA, decreased from 942,000 barrels at yearend 1971 to 814,000 barrels at yearend 1972, a decline of 13.6%.

Peat.—Illinois produced 69,523 short tons of peat in 1972, 4.5% less than the 72,823 short tons produced in 1971. Production was reported by five companies, two less than the previous year, from Kane, Lake, and Whiteside Counties. No production was reported from Cook County although some peat was shipped from stocks.

Sales totaling 74,003 short tons increased 3% over the 1971 sales. Humus, moss, and reed-sedge peat were sold in bulk and packaged forms. Eighty-seven percent of all sales were in packaged forms. The majority of the peat was used for general soil improvement; a small amount was used for potting soils.

Illinois continued to rank second to Michigan in output of peat in the United States, accounting for 12% of the Nation's total.

Petroleum.—Petroleum production in Illinois continued its downward trend for the 10th consecutive year. Output decreased from 39.1 million barrels in 1971 to 34.9 million barrels in 1972, a decline of

Table 7.—Illinois: Crude oil production, by county

(Thousand 42-gallon barrels and thousand dollars)

County	1971		1972	
	Quantity [1]	Value [2]	Quantity [1]	Value [2]
Adams	4	14	3	10
Bond	54	187	46	161
Brown	4	14	3	9
Champaign	(3)	1	--	--
Christian	418	1,450	355	1,230
Clark [4]	442	1,534	367	1,273
Clay	1,821	6,319	1,587	5,506
Clinton	708	2,457	678	2,354
Coles	303	1,051	236	818
Crawford	1,979	6,867	1,762	6,113
Cumberland	(4)	(4)	(4)	(4)
De Witt	180	625	160	554
Douglas	38	132	37	128
Edgar	103	357	112	390
Edwards	588	2,040	547	1,898
Effingham	356	1,235	304	1,054
Fayette	4,677	16,229	3,742	12,986
Franklin	773	2,682	667	2,314
Gallatin	742	2,575	673	2,335
Hamilton	1,399	4,854	1,161	4,028
Jasper	825	2,863	672	2,332
Jefferson	1,096	3,803	967	3,355
Lawrence	4,545	15,771	4,258	14,775
McDonough	42	146	39	136
Macon	7	24	5	18
Macoupin	(3)	(3)	1	5
Madison	121	420	137	476
Marion	3,542	12,291	3,295	11,434
Montgomery	1	3	(3)	1
Moultrie	3	10	3	10
Perry	17	59	20	70
Randolph	110	382	97	337
Richland	1,340	4,650	1,099	3,815
St. Clair	82	285	49	171
Saline	545	1,891	369	1,282
Sangamon	145	503	176	612
Shelby	40	139	33	115
Wabash	1,671	5,798	1,461	5,069
Washington	682	2,367	637	2,211
Wayne	4,149	14,397	3,574	12,403
White	5,370	18,634	4,475	15,529
Williamson	162	562	164	570
Unassigned	--	--	901	3,125
Total [5]	39,084	135,621	34,874	121,018

[1] Data based on information supplied by the Illinois Geological Survey.

[2] County values calculated by using State average value per barrel of $3.47 for both 1971 and 1972.

[3] Less than ½ unit.

[4] Production of Cumberland County included with Clark County because actual source of production cannot be identified.

[5] Data may not add to totals shown because of independent rounding.

Table 8.—Illinois: Oil and gas well drilling completions, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Adams	--	--	2	--	--	--	2	1,448
Bond	--	--	2	1	--	6	9	10,235
Brown	--	--	--	--	--	1	1	544
Christian	12	--	15	1	--	7	35	63,728
Clark	2	--	2	--	--	6	10	12,306
Clay	21	--	16	3	--	6	46	132,051
Clinton	1	--	5	--	--	3	9	14,929
Coles	3	11	2	--	--	--	16	38,488
Crawford	11	--	8	--	1	--	20	26,120
Cumberland	--	--	--	1	--	2	3	10,022
De Witt	2	--	--	--	--	1	3	2,695
Douglas	3	--	4	--	--	--	7	12,017
Edgar	6	1	4	--	--	1	12	5,771
Edwards	5	--	11	1	--	3	20	62,389
Effingham	2	--	4	--	--	--	6	15,109
Fayette	4	--	1	--	--	1	6	8,593
Franklin	1	--	2	--	--	2	5	13,286
Gallatin	7	1	13	1	--	2	24	61,127
Hamilton	1	--	1	--	--	--	2	6,120
Hancock	--	--	1	--	--	1	2	1,219
Jackson	--	--	--	--	--	1	1	940
Jasper	13	--	4	--	--	3	20	53,622
Jefferson	4	--	--	--	--	1	5	16,398
Lawrence	19	--	10	--	--	3	32	55,711
Logan	--	--	--	--	--	1	1	1,560
McDonough	--	--	1	--	--	1	2	941
McLean	--	--	--	--	--	2	2	1,763
Macon	--	--	2	--	--	1	3	6,521
Macoupin	--	--	--	--	--	1	1	625
Madison	4	--	5	--	--	2	11	10,237
Marion	7	--	7	1	--	5	20	53,377
Massac	--	--	--	--	--	1	1	635
Monroe	--	--	--	--	--	1	1	660
Morgan	--	--	--	1	--	--	1	294
Moultrie	--	--	--	--	--	1	1	1,862
Perry	1	--	--	--	--	--	1	1,160
Pike	--	--	--	--	--	1	1	922
Randolph	--	--	--	--	--	4	4	6,589
Richland	10	--	6	--	--	4	20	58,752
St. Clair	--	1	--	--	--	10	11	13,619
Saline	--	1	4	--	1	1	7	15,818
Sangamon	20	--	20	2	--	17	59	103,524
Shelby	1	--	--	--	--	--	1	2,155
Tazewell	--	--	--	--	--	1	1	1,374
Wabash	11	--	10	3	--	2	26	65,159
Washington	3	--	2	--	--	5	10	15,103
Wayne	47	--	25	2	--	4	78	242,969
White	11	--	11	--	--	1	23	44,686
Williamson	3	1	2	3	--	11	20	53,326
Total	**235**	**16**	**202**	**20**	**2**	**127**	**602**	**1,328,499**

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

11%. The weighted average price of crude oil was $3.47 per barrel. The value of crude petroleum provided 16% of the total State mineral output value.

A modest decline in the amount of work involving new waterflood projects was experienced during 1972. Field-scale projects using Maraflood products are being conducted in the Main Consolidated and Lawrence fields in eastern Illinois. Approximately 75% of the oil produced in the State is obtained through secondary recovery methods. According to the Illinois State Geological Survey, the current rate of decline in daily production appears to be following a typical composite waterflood decline curve rather than a stripper well decline rate, as might be expected with so large a portion of the oil produced by waterflood methods.

According to the American Petroleum Institute (API), proved reserves of crude oil were 174,883,000 barrels on December 31, 1972, compared with 208,763,000 barrels on December 31, 1971, a decrease of 16.2%.

Petroleum Refineries.—The only grass-roots refinery under construction in the United States, Mobil Oil Corp.'s 164,000-barrel-per-day refinery at Joliet, was completed in November and started up in December. Highlights of the refinery include its strategic location, its strong fuelmaking capability, its ability to process sour crudes, its air and water-pollution control systems, its energy-conservation measures and dual firing capability.

Eight other refineries were operated by six companies during 1972; three of these refineries were in Madison County, two in Cook County, and one each in Crawford, Lawrence, and Will Counties.

Petroleum and Natural Gas Exploration and Development.—Total number of well completions in Illinois increased from 564 wells in 1971 to 602 wells in 1972. Of the 602 wells drilled, 255 were completed as oil wells, 18 as gas wells, and 329 as dry holes. Overall success ratio was 45%; nearly 15% of the exploratory wells were completed as oil and gas producers.

Four new oilfields, discovered in 1971, were the Iuka South field in Marion County, the Dawson field in Sangamon County, the Elkton North field in Washington County, and the Stiritz field in Williamson County.

New fields discovered in 1972 were the Mechanicsburg field in Sangamon County, the Flora Southeast field in Clay County, and the Whiteash field in Williamson County. The discovery well of the Mechanicsburg field was W. A. Corley's No. 1–C Strawkas in sec. 25, T16N, R3W, which pumped 210 barrels of oil per day from Silurian perforations between the depths of 1,718 and 1,734 feet. The discovery well of the Flora Southeast field was Republic Oil Co.'s No. 1 Valbert well in sec. 11, T2N, R6E, which was completed pumping 30 barrels of oil and 20 barrels of water per day from Spar Mountain (Rosiclare) perforations at 3,068 to 3,073 feet after treatment. The discovery well of the Whiteash field was A. B. Vaughn's No. 1 Peabody well in sec. 26, T8S, R2E, which had an initial daily production of 85 barrels of oil from the Ohara pay zone at 2,532 feet.

NONMETALS

Cement.—Portland and masonry cements were produced by three companies in 1972. These were the Marquette Cement Manufacturing Co. at its Oglesby plant, LaSalle County; the Medusa Cement Co., a division of Medusa Corp., at its Dixon plant, Lee County; and the Missouri Portland Cement Co. at its Joppa plant, Massac County. Portland cement shipments increased 10.3% in quantity and 27.5% in value; masonry cement shipments increased 9.1% in quantity and 6.3% in value.

Types of portland cement shipped included type I and II (general use and moderate heat); type III (high-early-strength); white; waterproof; slag-pozzolan; block; and expansive. Portland cement consumed in the State totaled 3,606,330 tons; masonry cement consumed in the State totaled 115,894 tons. Raw materials used in making portland cement included limestone, sandstone, clay and shale, sand, gypsum, and iron-bearing materials. Disposition of portland cement by type of customer was as follows: ready-mix concrete companies (76%), concrete produce manufacturers (7%), building material dealers (10%), and contractors and other users (7%).

Table 9.—Illinois: Portland cement statistics

(Short tons unless otherwise specified)

	1971	1972
Number of active plants	3	3
Production	1,512,712	1,540,281
Shipments from mills:		
Quantity	1,424,718	1,571,188
Value	$25,974,803	$33,124,461
Stocks at mills, Dec. 31	126,525	180,135

Table 10.—Illinois: Masonry cement statistics

(Short tons unless otherwise specified)

	1971	1972
Number of active plants	3	3
Production	71,074	76,004
Shipments from mills:		
Quantity	73,047	79,661
Value	$2,335,759	$2,483,457
Stocks at mills, Dec. 31	12,503	9,173

In July the Centex Corp. completed acquisition of the old Alpha Portland Industries, Inc. (formerly Alpha Portland Cement Co.) plant, at LaSalle, LaSalle County; included was the distribution terminal in Chicago. The plant had been closed down since 1970. New equipment being installed included a 13.5-foot-diameter by 190-foot-long kiln equipped with a four-stage suspension preheater and an 11-foot by 34-foot finish grinding mill. Completion was scheduled for early 1974. The plant was to have a capacity of 376,000 tons.

At Oglesby, Marquette Cement Manufacturing Co. was replacing eight old kilns with one kiln that would increase annual capacity by 28,000 tons to a total of 771,000 tons when completed in January 1973. One new 13-foot by 43-foot, 4,400-horsepower finish grinding mill replaced 12 old mills.

Missouri Portland Cement Co. was installing a new finish mill at its Joppa plant. The 13-foot by 32.75-foot, 2,000-horsepower mill was scheduled for operation in June 1973.

Clays.—Production of clay and shale was reported from 14 counties (two less than in 1971). Output of fire clay and common clay and shale in 1972 was 1.7 million tons valued at $3.3 million. Fire clay was mined in Grundy, LaSalle, McDonough, and Scott Counties. The largest production of common clay and shale came from LaSalle County. Other counties producing more than 100,000 tons each of common clay and shale, in descending order of tonnage, were Cook County, Livingston County, and Vermilion County. Fuller's earth was produced in Pulaski County.

Fluorspar.—Shipments of finished fluorspar totaled 132,405 tons valued at nearly $10 million, a decrease of 4% in quantity and an increase of less than 1% in value compared with those of 1971. The State continued to be the Nation's leading producer of fluorspar, supplying about 53% of the output.

Gem Stones.—Small quantities of gem materials and mineral specimens continued to be collected in 1972. Estimated total value of the materials in 1972 remained the same as the 1971 estimate. Gem stones contribute only a very minor amount of the State's total mineral value.

Gypsum.—National Gypsum Co. calcined gypsum at Waukegan, Lake County. Output increased 15%.

Iron Oxide Pigments.—Three plants, operating in Adams, Kane, and St. Clair Counties, produced finished (natural and manufactured) iron oxide pigments in 1972. Among producing States, Illinois ranked first surpassing Pennsylvania.

Lime.—Illinois ranked sixth in the Nation in lime production. Output in the State increased 5% compared with that of the previous year but was 4% below the 1969 record. Producing companies were Marblehead Lime Co., with four plants in Adams and Cook Counties, and Vulcan Materials Co., which acquired Standard Lime & Refractories Co.'s plant in Cook County. The lime was used in steel furnaces, refractories, water purification, and other purposes. The lime was consumed in Indiana, Illinois, Iowa, and other destinations. Total lime consumption in Illinois was 1,023,000 tons.

Among the top safety honor winners announced for the 1971 National Lime Association Safety Competition was the Thornton Plant, General Dynamics Corp., Marblehead Lime Co. Div., Lyons, Ill.

Perlite.—Crude perlite mined outside the State was expanded by five companies with plants in Cook, De Kalb, Lake, and Will Counties. Sales of the expanded product increased 15.9% in quantity and 18.6% in value. Principal uses were for roof insulation and for low-temperature insulation, accounting for 69.8% and 11.6%, respectively. Other uses included filter aid, concrete aggregate, plaster aggregate, and horticultural aggregates. Illinois continued to lead the country in production of expanded perlite and also in the quantity that producers used and sold.

Sand and Gravel.—Illinois ranked fourth in the Nation in quantity and third in value of sand and gravel produced. Production in 1972 was 39.9 million tons valued at $61.7 million. Counties from which over 1 million tons was produced in 1972 were Du Page, Grundy, Kane, La Salle, McHenry, White, Will, and Winnebago.

Of the total sand and gravel produced, 42% was used as paving material, 33% as building material, and the remainder as industrial sands, railroad ballast, and fill. The average value of the total sand and gravel produced was $1.54 per ton.

Stone.—Illinois, with production of 56.3 million tons, continued to rank second only to Pennsylvania in total tonnage of stone produced in the United States.

Major producing counties, each with production of over 1 million short tons, were Cook, Hardin, Kane, Kankakee, La Salle, Lee, Livingston, Randolph, Rock Island, St. Clair, Vermilion, Will, and Winnebago.

Dimension stone, which represented only a small part of the total stone production in the State, was produced in Kane and Monroe Counties.

Table 11.—Illinois: Sand and gravel sold or used by producers by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972 [1]	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	95	318	184	W
Building	7,810	8,330	6,585	7,753
Fill	2,398	1,965	2,541	2,312
Glass	1,382	4,242	2,367	7,330
Molding	807	3,036	1,362	5,668
Paving	8,499	10,199	7,819	8,998
Other uses [2]	819	1,643	1,310	6,222
Total [3]	21,812	29,732	22,117	38,284
Gravel:				
Building	7,642	9,081	6,632	8,574
Fill	1,255	1,068	1,528	1,504
Paving	13,377	18,229	8,590	12,175
Miscellaneous	360	364	312	371
Other uses [4]	382	433	352	419
Total [3]	23,016	29,175	17,416	23,044
Government-and-contractor operations:				
Sand:				
Building	5	5	(5)	(5)
Fill	--	--	36	2
Paving	81	79	42	44
Total	86	84	78	46
Gravel:				
Building	16	21	3	2
Fill	27	37	18	35
Paving	408	349	298	286
Other uses	--	--	(4)	(4)
Total [3]	450	406	318	323
Total sand and gravel [3]	45,364	59,397	39,929	61,696

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Data not directly comparable with that of previous years because of changes in coverage.

[2] Includes abrasives, chemicals, enamel (1972), engine, filtration, foundry, grinding and polishing (1971), oil (hydrofrac) (1972), pottery and other uses.

[3] Data may not add to totals shown because of independent rounding.

[4] Includes railroad ballast.

[5] Less than ½ unit.

Trucks transported about 92% of the crushed and broken stone; the remainder was shipped by railroad (6%) and waterway (2%) transportation.

Sulfur (Recovered Elemental).—Sulfur was recovered by The Anlin Co. of Illinois, a subsidiary of Alaska Interstate Co., in Madison County; by Union Oil Co. of California, Union 76 Div., in Cook County; and Marathon Oil Co. in Crawford County. Nationally, Illinois ranked fourth in quantity and value of recovered sulfur.

The Anlin Co. of Illinois processed the gas streams from the Wood River refineries of Shell Oil Co., Clark Oil & Refining Corp., and the American Oil Co. In connection with a long-term contract with Shell Oil Co., Anlin obtained from the Illinois Environmental Protection Agency all of the necessary permits to essentially duplicate its sulfur recovery facilities on its Wood River plant site. Permits also have been obtained to construct a 100,000-ton-per-year sulfuric acid plant, which will be used primarily to reconstitute spent acid from Shell's Wood River refinery.

According to the 1972 Annual Report of the Alaska Interstate Co., Mineral & Chemical Resource Co. jointly with Delta Engineering Corp. has built and successfully put into operation two separate, pilot-size, tail gas units at Anlin's Wood River sulfur plant. Patent applications were filed on both of the processes. One process is said to produce marketable sulfur, which is essentially pure, while reducing sulfur dioxide emission to less than 20% of the levels achieved by the typical sulfur recovery

Table 12.—Illinois: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972[1]		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Brown	1	W	W	1	12	12
Bureau	10	579	613	10	417	432
Carroll	1	14	19	1	W	W
Champaign	8	701	779	9	673	722
Clark	5	W	W	4	359	457
Clinton	2	W	W	5	153	133
Coles	3	W	W	4	239	W
Cook	8	2,024	2,697	4	911	W
Crawford	2	W	W	3	347	294
De Kalb	4	374	W	5	549	671
Du Page	6	1,372	2,091	5	1,086	W
Effingham	--	5	17	--	--	--
Fulton	8	650	866	4	W	W
Gallatin	2	260	273	2	260	259
Hamilton	--	2	3	--	--	--
Henderson	--	--	--	1	(2)	(2)
Jackson	1	W	W	1	50	57
Jasper	1	15	19	--	--	--
Johnson	1	25	3	--	--	--
Kane	14	5,314	6,354	10	3,203	4,001
Kankakee	1	W	W	2	16	W
Kendall	3	494	480	2	W	W
Lake	10	2,042	1,574	6	849	1,080
La Salle	13	2,882	7,871	14	4,898	17,634
Lawrence	4	459	468	4	458	467
Logan	5	W	W	5	438	511
McDonough	1	30	3	1	W	W
McHenry	25	7,208	7,934	16	W	W
Macon	4	502	553	4	W	W
Madison	7	1,091	739	3	341	382
Mercer	1	4	4	--	--	--
Moultrie	--	W	W	1	13	W
Pope	1	5	(2)	1	2	(2)
Pulaski	4	11	7	--	--	--
Rock Island	4	909	696	5	W	785
St. Clair	--	--	--	1	W	181
Sangamon	5	839	898	4	880	1,150
Stephenson	3	W	W	1	71	133
Tazewell	9	1,426	2,243	8	W	W
Union	1	17	12	1	16	12
Vermilion	7	274	232	7	304	215
Wabash	2	W	W	3	170	W
White	4	942	831	5	1,106	993
Will	9	3,052	4,607	12	3,272	4,588
Winnebago	11	1,111	1,103	9	1,414	1,454
Woodford	4	W	W	5	702	1,173
Undistributed[3]	[r]76	10,732	15,410	82	16,721	23,902
Total[4]	**291**	**45,364**	**59,397**	**269**	**39,929**	**61,696**

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Data not directly comparable with that of previous years because of changes in coverage.

[2] Less than ½ unit.

[3] Includes Adams, Alexander, Bond, Boone, Cumberland (1972), Dewitt, Fayette, Ford, Grundy, Henry, Iroquois, Jo Daviess, Lee, Livingston, McLean, Marshall, Mason, Massac, Morgan (1971), Ogle, Peoria, Pike, Putnam, Randolph, Schuyler, Scott, Shelby, Stark, Whiteside Counties and some sand and gravel that cannot be assigned to specific counties.

[4] Data may not add to totals shown because of independent rounding.

plant. The other process is reported to be capable of reducing sulfur dioxide emission levels to less than 2.5% of current levels.

Tripoli (Amorphous Silica).—Crude material was recovered from underground mines in Alexander County by Illinois Minerals Co. near Elco, and by Tammsco Inc. near Tamms. The production of crude material increased 21.6% in quantity and 62.7% in value. Output of prepared material increased 20.1% in quantity and 28.4% in value. Prepared material was used for abrasives, filler, and other purposes. Of the few States that produce tripoli in the United States, Illinois ranked first in production and second in value.

Vermiculite.—Crude vermiculite mined outside the State was processed by the W. R. Grace & Co. (Construction Products Div.) at its plant in Cook County; Mica Pellets, Inc., at its plant in De Kalb

Table 13.—Illinois: Limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension total	4	60	W	W
Crushed and broken:				
Bituminous aggregate	7,376	12,745	5,190	9,427
Concrete aggregate	9,155	14,989	10,142	17,284
Dense graded road base stone	17,191	26,129	17,198	28,584
Macadam aggregate	3,189	5,378	1,497	2,605
Surface treatment aggregate	5,871	9,481	5,615	9,426
Unspecified construction aggregate and roadstone	2,836	4,712	4,026	6,664
Agricultural purposes [1]	4,113	6,643	4,024	6,790
Cement manufacture	2,219	2,380	2,506	3,001
Fill	11	20	[2]	[2]
Flux stone	758	1,105	779	1,315
Railroad ballast	752	1,157	454	691
Riprap and jetty stone	637	919	629	1,069
Other uses [3]	3,237	8,338	4,205	7,368
Total [4]	57,346	93,997	56,260	94,225
Grand total	57,350	94,058	W	W

W Withheld to avoid disclosing individual company confidential data.

[1] Includes agricultural limestone and poultry grit.

[2] Included with "Other uses."

[3] Includes stone for asphalt filler, chemical stone (1972), lime manufacture, stone sand, mine dusting (1972), other filler, roofing aggregates, chips, and granules, waste material (1972), whiting, uses not specified, chemicals (1971), and building products (1971).

[4] Data may not add to totals shown because of independent rounding.

County; and International Vermiculite Co. at its plant in Macoupin County. Uses were for insulation, aggregate in plaster and concrete, horticulture, and other purposes.

METALS

Lead and Zinc.—Production of 1,335 short tons of lead and 11,378 short tons of zinc, in terms of recoverable metal, represented an increase of 7.8% and a decrease of 10.5%, respectively, from the 1971 figures. In terms of value, lead production increased 17.3% and zinc production declined 1.3%. Average weighted annual prices used to calculate values of lead and zinc in table 1 were 15.03 cents and 17.75 cents per pound, respectively. These averages compared with 13.8 cents per pound for lead and 16.1 cents per pound for zinc in 1971.

In northern Illinois (Jo Daviess County), Eagle-Picher Industries, Inc., operated the Bautsch and Gray mines; the Blackjack mine was abandoned as of May 1971. The Gray mine closed in September 1972, and the Bautsch mine is scheduled to close in May 1973.

In southern Illinois (Hardin County), the Minerva Oil Co. and Ozark-Mahoning Co. recovered lead and zinc as byproducts of fluorspar operations.

The Illinois Pollution Control Board (IPCB) agreed to allow the New Jersey Zinc Co. to reopen its sulfuric acid plant at Depue. The IPCB agreed with the company's contention that it would be able to remove 98% of the sulfur dioxide emissions since it does not plan to reopen its zinc smelter, which had been the main problem.

The American Zinc Co.'s electrolytic zinc plant in Sauget was purchased by American Metal Climax, Inc. (AMAX) in June 1972. AMAX is in the process of reactivating the plant. Improvements underway include complete rebuilding of the electrolytic cell room and the addition of a hot purification step that makes it possible to handle concentrates from mines in southeast Missouri. The facility also will use concentrates from other domestic mines and from Canada. Concentrates from the company's joint mining venture with Homestake Mining Co., previously sent to the Amax Blackwell, Okla., smelter, which is being phased out, will be sent to Sauget.

Current plans call for plant startup and initial zinc shipments in 1973 and operation at full capacity by 1975. When operating at full capacity, the plant is expected to produce 84,000 tons of Special-High-grade zinc, 1.35 million pounds of cad-

Table 14.—Illinois: Crushed stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971		1972 [1]	
	Quantity	Value	Quantity	Value
Adams	1,097	3,074	W	W
Calhoun	35	W	W	W
Carroll	322	388	494	669
Champaign	--	--	2	15
Christian	W	W	694	1,077
Clark	1,018	1,845	W	W
Coles	W	W	489	948
Ford	--	--	6	11
Greene	340	W	307	W
Hancock	219	362	495	805
Hardin	1,811	2,650	2,352	3,287
Henderson	299	507	311	522
Iroquois	--	--	18	29
Jackson	W	W	318	W
Jersey	120	211	107	190
Jo Daviess	282	315	280	298
Kane	1,157	1,987	1,265	2,288
Lake	W	W	1	2
La Salle	4,569	11,615	W	W
Lee	1,085	1,390	1,677	2,391
Livingston	2,465	4,215	1,931	3,182
Macon	--	--	79	259
Massac	W	690	W	674
Moultrie	W	W	5	10
Ogle	752	1,100	746	1,191
Pike	671	1,112	535	898
Randolph	1,428	3,079	1,456	2,246
St. Clair	2,694	3,858	2,436	3,957
Sangamon	26	39	W	W
Scott	325	571	W	776
Stephenson	711	812	308	399
Will	4,549	6,889	3,783	6,225
Winnebago	728	1,150	1,314	2,121
Undistributed [2]	35,288	58,226	34,850	59,755
Total [3]	61,991	106,084	56,260	94,225

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Data not directly comparable with that of previous years because of changes in coverage.

[2] Includes stone produced in the following counties: Boone, Brown (1971), Clay, Clinton, Cook, Crawford (1971), Cumberland, De Kalb, Douglas, Du Page, Fayette, Grundy (1971), Henry, Johnson, Kankakee, Kendall, Knox, Lawrence (1972), Logan, McDonough, McHenry, Macoupin, Madison, Marion, Mason (1971), Menard, Mercer, Monroe, Montgomery, Peoria, Pulaski, Rock Island, Schuyler, Shelby, Union, Vermilion, Warren, Washington, and Whiteside, and production for which no county breakdown is available.

[3] Data may not add to totals shown because of independent rounding.

Table 15.—Illinois: Mine production (recoverable) of lead and zinc

	1970	1971	1972
Mines producing: Lode [1]	6	4	2
Material sold or treated (ore):			
Fluorspar thousand short tons	348	320	346
Zinc do	266	230	211
Production (recoverable):			
Quantity:			
Lead short tons	1,532	1,238	1,335
Zinc do	16,797	12,706	11,378
Value:			
Lead thousands	$479	$342	$401
Zinc do	5,146	4,091	4,039
Total do	5,625	4,433	4,440

[1] Fluorspar operations producing byproduct lead and zinc not included in mine count.

mium, and 150,000 tons per year of sulfuric acid.

Pig Iron and Steel.—About 7.2 million tons of pig iron, valued at $543 million was shipped from Illinois blast furnaces or was consumed by the producing companies. This output represented an increase of 11% from 1971 production. Pig iron was produced by five companies operating blast furnaces in Granite City and South Chicago.

According to the American Iron and Steel Institute, Illinois produced 12.2 million short tons of steel in 1972 compared with 10.9 million short tons in 1971.

Silver.—Small amounts of silver were recovered in smelter operations by Minerva Oil Co. and Ozark-Mahoning Co. in Hardin County and by Eagle-Picher Industries, Inc., in Jo Daviess County.

Table 16.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Marquette Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	Portland and masonry, dry process.	La Salle.
Medusa Cement Co., Div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	do	Lee.
Missouri Portland Cement Co.	7751 Carondelet Ave. St. Louis, Mo. 63105	do	Massac.
Clays and shale:			
American Brick Co.	6558 West Fullerton Ave. Chicago, Ill. 60635	Pit and plant	Cook.
A. P. Green Refractories Co. (Div. of U.S. Gypsum Co.)	Box 64 Morris, Ill. 60450	do	Grundy.
Illinois Brick Co.	228 North La Salle St. Chicago, Ill. 60601	do	Cook.
Marblehead Lime Co. (General Dynamics Corp.)	300 West Washington St. Chicago, Ill. 60606	do	La Salle.
Marquette Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	Pit	Do.
Richards Brick Co.	234 Springer Ave. Edwardsville, Ill. 62025	Pit	Bond.
Southern Clay Co., Inc. (Lowe's Inc.)	North Edward St. Cassopolis, Mich. 49031	Pit and plant	Pulaski.
Streator Brick Systems, Inc.	West End of 9th St. Streator, Ill. 61364	Pits	La Salle and Livingston.
Western Brick Co. (Div. of Illinois Brick Co.)	Box 591 Danville, Ill. 61832	do	Vermilion.
Coal (bituminous):			
Amax Coal Co., Div. of American Metal Climax, Inc.:	105 S. Meridian St. Indianapolis, Ind. 46225		
Sun Spot		Strip mine; cleaning plant.	Fulton.
Leahy		do	Perry.
Delta		do	Williamson.
Consolidation Coal Co., Midwestern Div.	P.O. Box 218 Pinckneyville, Ill. 62274		
Hillsboro		Underground mine.	Montgomery.
Norris		Strip mine; cleaning plant.	Fulton.
Burning Star No. 2		do	Perry.
Burning Star No. 3		do	Randolph.
Eads Coal Co.	Box 1473 St. Louis, Mo. 63178	Strip mine	Jefferson.
Forsyth-Energy, Inc.	P.O. Box 488 Herrin, Ill. 62948	Strip mine; cleaning plant.	Williamson.
Freeman Coal Mining Corp.:	300 W. Washington St. Chicago, Ill. 60606		
Orient No. 5		Underground mine; cleaning plant.	Franklin.
Orient No. 3		do	Jefferson.
Orient No. 6		do	Do.
Orient No. 4		do	Williamson.
Inland Steel Co.:	30 West Monroe St. Chicago, Ill. 60603		
Inland		do	Jefferson.
Midland Coal Co., Div. of American Smelting and Refining Co.:	P.O. Box 8 Trivoli, Ill. 61569		
Allendale		Strip mine; cleaning plant.	Stark.
Mecco		do	Knox.
Edwards		do	Peoria.
Elm No. 1		do	Do.
Elm No. 2		do	Fulton.
Monterey Coal Co.	205 Oakland Ave. Carlinville, Ill. 62626	Underground mine; cleaning plant.	Macoupin.
Old Ben Coal Corp.:	10 South Riverside Plaza Chicago, Ill. 60606		
Old Ben No. 21		do	Franklin.
Old Ben No. 24		Underground mine.	Do.
Old Ben No. 26		Underground mine; cleaning plant.	Do.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal (bituminous)—Continued			
Peabody Coal Co.:	301 North Memorial Dr. St. Louis, Mo. 63102		
No. 10		Underground mine; cleaning plant.	Christian.
Eagle		Strip and underground mines; cleaning plant.	Gallatin.
Northern Illinois		Strip mine; cleaning plant.	Kankakee.
Baldwin No. 1		Underground mine; cleaning plant.	Randolph.
Midwest Highwall No. 3		do	St. Clair.
River King		Strip and underground mines; cleaning plant.	Do.
Will Scarlet		Strip mine; cleaning plant.	Williamson.
Sahara Coal Co., Inc.:	59 East Van Buren St. Chicago, Ill. 60605		
No. 5		Underground mine.	Saline.
No. 6		Strip mine; cleaning plant.	Do.
No. 20		Underground mine.	Do.
No. 21		do	Do.
Southwestern Illinois Coal Corp.:	Box 14743 St. Louis, Mo. 63178		
Captain		Strip mine; cleaning plant.	Perry.
Streamline		do	Randolph.
The United Electric Coal Cos.:	300 W. Washington St. Chicago, Ill. 60606		
Buckheart No. 17		do	Fulton.
Banner No. 27		do	Peoria.
Fidelity No. 11		do	Perry.
Zeigler Coal Co.:	208 South La Salle St. Chicago, Ill. 60604		
Murdock		Underground mine; cleaning plant.	Douglas.
Spartan No. 2		do	Randolph.
Zeigler No. 4		do	Williamson.
Coke:			
Granite City Steel Co	Box 367 Granite City, Ill. 62041	Coke ovens	Madison.
Interlake Steel Corp	135th St. and Perry Ave. Chicago, Ill. 60627	do	Cook.
International Harvester Co	401 North Michigan Ave. Chicago, Ill. 60611	do	Do.
Republic Steel Corp	Box 6778 Cleveland, Ohio 44101	do	Do.
Fluorspar:			
Minerva Company, Mining Div. Minerva Oil Co.:	Eldorado, Ill. 62930		
Crystal Group		Underground mines, mill.	Hardin.
Minerva No. 1		Underground mine, mill.	Do.
Ozark-Mahoning Co	Box 57 Rosiclare, Ill. 62982	Underground mines, mill.	Do.
Iron and Steel:			
Granite City Steel Co	Box 365 Granite City, Ill. 62040	Iron and steel furnaces.	Madison.
Interlake Steel Corp	135th St. and Perry Ave. Chicago, Ill. 60627	Iron furnaces	Cook.
Republic Steel Corp	Box 6778 Cleveland, Ohio 44101	Iron furnace and steel furnace.	Do.
United States Steel Corp	3426 East 89th St. Chicago, Ill. 60617	Iron and steel furnaces.	Do.
Wisconsin Steel Division, International Harvester Co.	401 North Michigan Ave. Chicago, Ill. 60611	do	Do.
Iron-oxide pigments (Finished):			
Minerals, Pigments & Metals Div., Chas. Pfizer & Co., Inc.	2001 Lynch Ave. East St. Louis, Ill. 62201	Plant	St. Clair.
Prince Manufacturing Co., Inc	Bowmanstown, Pa. 18030	do	Adams.
George B. Smith Chemical Works, Inc.	Maple Park, Ill. 60151	do	Kane.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Lead and zinc:			
Eagle-Picher Industries, Inc.: Bautsch and Gray.	Box 406 Galena, Ill. 61036	Underground mines, mill.	Jo Daviess.
Minerva Company, Mining Div. Minerva Oil Co.:	Eldorado, Ill. 62930		
Minerva No. 1		Underground mine, mill.	Hardin.
Ozark-Mahoning Co.	Box 57 Rosiclare, Ill. 62982	Underground mines, mill.	Do.
Lime:			
Marblehead Lime Co.: Marblehead Limekiln	300 West Washington St. Chicago, Ill. 60606	Quicklime and hydrated lime, 3 shaft kilns.	Adams.
Quincy Limekiln		Quicklime 1 calcimatic kiln.	Do.
South Chicago Limekiln		Quicklime and hydrated lime, 4 rotary kilns.	Cook.
Thornton Limekiln		do	Do.
Vulcan Materials Co	Box 6 Countryside, Ill. 60525	Quicklime, 3 rotary kilns.	Do.
Natural gas liquids: U.S. Industrial Chemicals Co., Div. of National Distillers & Chem. Corp.	99 Park Ave. New York, N.Y. 10016	Plant	Douglas.
Peat:			
Anderson Peat Co	Morrison, Ill. 61270	Bog, processing plant.	Whiteside.
Markman Peat Co	Route 3 Morrison, Ill. 61270	do	Do.
Expanded perlite:			
Filter Products Corp	124 North Bueschfirg Rd. Lake Zurich, Ill. 60047	Processing plant	Lake.
Johns-Manville Perlite Corp., Building Products Div.	Box 5108 Denver, Colo. 80217	do	Will.
Mica Pellets, Inc	1008 Oak St. De Kalb, Ill. 60115	do	De Kalb.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Lake.
Silbrico Corp	6300 River Rd. La Grange, Ill. 60525	do	Cook.
Petroleum refineries:			
American Oil Co	910 South Michigan Ave. Chicago, Ill. 60680	Refinery	Madison.
Clark Oil & Refining Co	8530 West National Ave. Milwaukee, Wis. 53227	do	Cook and Madison.
Marathon Oil Co	539 South Main Findlay, Ohio 45840	do	Crawford.
Shell Oil Co	One Shell Plaza Houston, Tex. 77002	do	Madison.
Texaco Inc	135 East 42d New York, N.Y. 10017	do	Lawrence and Will.
Union Oil Co. of California	Union Oil Center Los Angeles, Calif. 90017	do	Cook.
Sand and gravel:			
Elmhurst-Chicago Stone Co	400 West 1st St. Elmhurst, Ill. 61026	Pits; portable and stationary plants.	Du Page, Kane, Will.
General Dynamics Corp	4226 S. Lawndale Ave. Lyons, Ill. 60534	Pits; dredges; stationary plants.	Cook, Grundy, McHenry, Will.
McHenry Sand & Gravel Co., Inc.	920 North Front St. McHenry, Ill. 60050	Pits; stationary plants.	McHenry.
Martin Marietta Aggregates	Box 789 Cedar Rapids, Iowa 52406	Pits; portable and stationary plants.	Fulton, Ogle, Peoria, Tazewell, Woodford.
Meyer Aggregate	Box 56, Route 2 Algonquin, Ill. 60102	do	Kendall and McHenry.
Moline Consumers Co	313 16th St. Moline, Ill. 61265	Pits; dredges; portable and stationary plants.	LaSalle, Pike, Rock Island.
Ottawa Silica Co	Box 577 Ottawa, Ill. 61350	Pit; portable and stationary plants.	La Salle.
Road Materials Corp., E. M. Melahn Construction Co., Inc.	Box 205 East Dundee, Ill. 60118	Pits; stationary plants.	Kane and McHenry.
Vulcan Materials Co	Box 391 LaGrange, Ill. 60525	Pits; portable and stationary plants.	Do.
Wedron Silica Co., Del Monte Properties Co.	400 West Higgins Road Park Ridge, Ill. 60068	Pit; stationary plant.	La Salle.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Smelters and refineries:			
American Smelting & Refining Co	120 Broadway New York, N.Y. 10005	Zinc secondary plant.	Montgomery.
NL Industries, Inc	111 Broadway New York, N.Y. 10006	Lead secondary plants.	Cook and Madison.
Richardson Graphics	18005 54th Ave. Chicago, Ill. 60650	Lead secondary plant.	Cook.
Stone:			
Columbia Quarry Co	Box 1000 Dupo, Ill. 62239	Quarries; stationary plants.	Johnson, Massac, Pulaski, St. Clair.
		Underground mine; stationary plant.	Monroe.
Elmhurst-Chicago Stone Co	400 West 1st St. Elmhurst, Ill. 61026	Quarry; stationary plant.	Du Page.
General Dynamics Corp	4226 S. Lawndale Ave. Lyons, Ill. 60534	Underground mine; stationary plant.	Adams.
		Quarries; stationary plants.	Cook, Vermilion, Will.
Industrial Chemicals Div., Allied Chemicals Corp.	Box 70 Morristown, N.J. 07960	do	Randolph.
Marquette Cement Mfg. Co	20 North Wacker Dr. Chicago, Ill. 60606	Quarry; stationary plant.	La Salle.
Medusa Corp	Box 5668 Cleveland, Ohio 44101	Quarries; stationary plants.	Clark, Henderson, Kankakee, Lee.
Mississippi Lime Co	7 Alby St., Box 247 Alton, Ill. 62002	Underground mine; stationary plant.	Madison.
Moline Consumers Co	313 16th St. Moline, Ill. 61255	Quarries; portable and stationary plants.	Adams, Henry, Pike, Rock Island, Schuyler, Warren.
Rein, Schultz & Dahl, Inc	6217 Nesbitt Rd. Madison, Wis. 53711	Quarries; portable plants.	Carroll, Stephenson, Whiteside, Winnebago.
Vulcan Materials Co	Box 391 LaGrange, Ill. 60525	Quarries; stationary plants.	Cook and Will.
Sulfur (recovered):			
Anlin Co. of Illinois	Box 6554 Houston, Tex. 77005	Byproduct sulfur recovery.	Madison.
Marathon Oil Co	Robinson, Ill. 62454	do	Crawford.
Union Oil Co. of California	Box 239 Lemont, Ill. 60439	do	Cook.
Tripoli (amorphous silica):			
Illinois Minerals Co	218 10th St. Cairo, Ill. 62914	Underground mine.	Alexander.
Tammsco Inc	Box J Tamms, Ill. 62988	do	Do.
Vermiculite, exfoliated:			
International Vermiculite Co	1st and Mound Sts. Girard, Ill. 62640	Processing plant	Macoupin.
Mica Pellets, Inc	1008 Oak St. De Kalb, Ill. 60115	do	De Kalb.
Construction Products Div., W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	do	Cook.

The Mineral Industry of Indiana

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior and the Geological Survey, Indiana Department of Natural Resources, for collecting information on all minerals except fuels.

By Brinton C. Brown [1]

Indiana continued to rank 25th in the United States in value of its mineral production, which reached another alltime high of $322,608,000 in 1972, surpassing last year's record by 15%. For the first time since 1957 the combined value of three mineral fuels amounted to more than half of the value of all minerals produced in the State. Increased coal output together with higher prices were responsible for the greatest share of Indiana's mineral production value increase. Production of all nonmetallic minerals increased in quantity and value with the exception of portland cement. Production of crude petroleum, peat, and natural gas each decreased. Although no metallic minerals were mined in the State during 1972, large quantities of iron, steel, and aluminum were produced.

Mineral production value in the State was divided as follows: coal, 45%; crushed stone, 13%; sand and gravel, 10%; crude petroleum, 7%; dimension stone, 3%; clays, 1%; portland and masonry cements, lime, gypsum, peat, natural gas, abrasives, and fire clay, the remainder.

Legislation and Government Programs.—During the year no less than 10 bills involving strip mining controls were introduced in the United States Congress. Both the Senate and House Committees on Interior and Insular Affairs conducted hearings on these bills. The following Federal legislation enacted during 1972 can affect mineral producing operations: Public Law 92–500 (October 18) Federal Water Pol-

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[1] Mining engineer, Division of Nonmetallic Minerals—Mineral Supply.

Table 1.—Mineral production in Indiana [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays ......thousand short tons..	1,325	$2,308	[2] 1,419	[2] $2,465
Coal (bituminous) ......do....	21,396	110,796	25,949	144,688
Natural gas ......million cubic feet..	587	r 89	355	55
Peat ......thousand short tons..	50	W	45	478
Petroleum (crude) ......thousand 42-gallon barrels..	6,658	22,770	6,130	20,964
Sand and gravel ......thousand short tons..	24,982	29,094	27,978	33,290
Stone ......do....	26,233	48,218	27,511	50,919
Value of items that cannot be disclosed: Abrasives (whetstones), cement (masonry and portland), fire clay, gypsum, lime, and values indicated by symbol W......	XX	68,246	XX	69,749
Total......	XX	r 281,521	XX	322,608
Total 1967 constant dollars......	XX	239,377	XX	p 268,378

p Preliminary. r Revised. W Withheld to avoid disclosing individual company confidential data included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

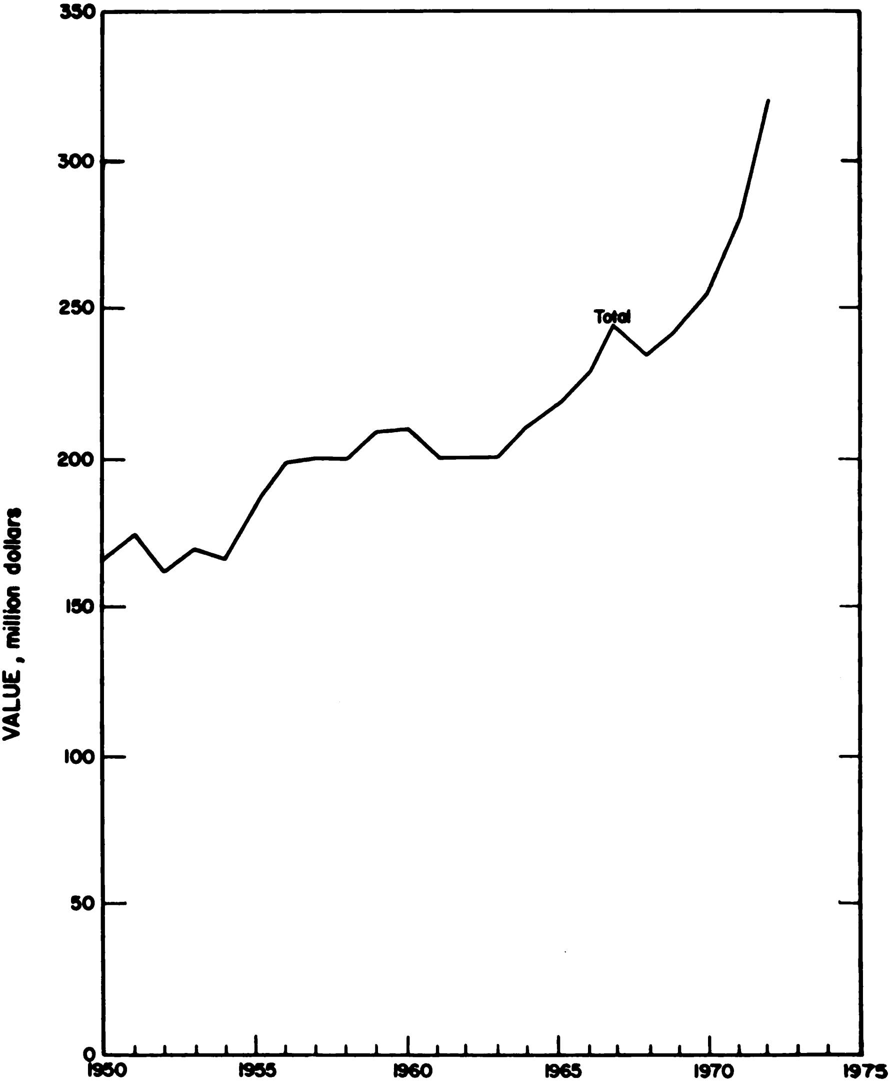

Figure 1.—Total value of mineral production in Indiana.

lution Control Act Amendments of 1972; Public Law 92–532 (October 23) to ban the unregulated dumping of materials into the oceans, estuaries and Great Lakes; Public Law 92–574 (October 27) Environmental Noise Control Act of 1972; and Public Law 92–322 (June 30) granting congressional consent to a 3-year extension of an interstate compact to conserve oil and gas (compact was signed by a representative from Indiana).

During the 1972 Indiana legislative session the following bills were passed that amend the 1971 Indiana Code (IC 1971) and may affect the mineral industry:

1. Senate Bill 100, Public Law 100,

Table 2.—Value of mineral production in Indiana, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	$726	$675	Stone, sand and gravel, clays.
Allen	8,871	8,922	Stone, sand and gravel, peat.
Bartholomew	840	W	Stone, sand and gravel.
Benton	W	--	
Blackford	W	W	Stone, clays.
Boone	W	W	Sand and gravel.
Brown	W	--	
Carroll	W	W	Stone, sand and gravel.
Cass	W	W	Cement, stone, sand and gravel, clays.
Clark	W	W	Do.
Clay	W	W	Coal, clays.
Clinton	W	13	Sand and gravel.
Crawford	W	W	Stone.
Daviess	W	W	Sand and gravel.
Dearborn	868	W	Do.
Decatur	W	W	Stone.
De Kalb	368	W	Sand and gravel.
Delaware	1,467	1,531	Stone, sand and gravel, peat.
Dubois	W	W	Clays.
Elkhart	W	W	Sand and gravel, stone.
Fayette	W	W	Do.
Fountain	829	W	Sand and gravel, coal, clays.
Franklin	W	W	Stone, sand and gravel, clays.
Fulton	W	W	Sand and gravel, peat, stone.
Gibson	W	W	Coal, sand and gravel.
Grant	W	819	Stone, sand and gravel, peat.
Greene	W	15,578	Coal, sand and gravel, clays.
Hamilton	5,215	W	Sand and gravel, stone.
Hancock	W	83	Sand and gravel.
Harrison	W	1,832	Sand and gravel, stone.
Hendricks	W	W	Stone, sand and gravel.
Henry	W	W	Sand and gravel.
Howard	W	W	Stone, sand and gravel.
Huntington	W	1,457	Stone, sand and gravel, clays.
Jackson	499	W	Sand and gravel, clays.
Jasper	W	W	Stone, sand and gravel.
Jay	W	W	Do.
Jefferson	5	4	Sand and gravel.
Jennings	W	W	Stone.
Johnson	W	W	Sand and gravel.
Knox	548	501	Do.
Kosciusko	W	509	Do.
Lagrange	W	280	Sand and gravel, stone.
Lake	W	W	Cement, lime, sand and gravel, stone, clays.
La Porte	W	1,155	Sand and gravel, stone.
Lawrence	16,833	16,289	Cement, stone, clays.
Madison	W	4,560	Sand and gravel, stone.
Marion	W	W	Do.
Marshall	W	W	Sand and gravel, stone, peat.
Martin	W	W	Gypsum, clays.
Miami	W	W	Sand and gravel, stone.
Monroe	W	7,103	Stone.
Montgomery	W	81	Sand and gravel, clays.
Morgan	W	W	Sand and gravel, clays, stone.
Newton	W	W	Stone.
Noble	331	389	Sand and gravel.
Orange	W	W	Stone, abrasives.
Owen	857	984	Stone, sand and gravel.
Parke	846	414	Sand and gravel, clays, coal.
Perry	W	W	Stone, sand and gravel.
Pike	W	W	Coal, stone.
Porter	W	W	Clays.
Posey	W	W	Sand and gravel.
Pulaski	W	W	Stone, clays.
Putnam	W	W	Cement, stone, sand and gravel.
Randolph	W	W	Stone, sand and gravel.
Ripley	W	W	Do.
Rush	W	W	Do.
St. Joseph	927	934	Sand and gravel, stone.
Scott	W	W	Stone.
Shelby	W	W	Stone, sand and gravel.
Spencer	W	941	Coal.
Starke	W	49	Stone, sand and gravel.
Steuben	W	W	Sand and gravel, stone.
Sullivan	22,345	21,960	Coal, sand and gravel, stone.
Switzerland	W	W	Sand and gravel, stone.
Tippecanoe	W	1,113	Do.
Union	8	4	Sand and gravel.
Vermillion	6,206	11,075	Coal, sand and gravel, clays.

See footnotes at end of table.

Table 2.—Value of mineral production in Indiana, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Vigo	W	$1,563	Sand and gravel, coal, stone.
Wabash	W	W	Stone, sand and gravel.
Warren	W	W	Sand and gravel, peat.
Warrick	W	46,751	Coal, stone.
Washington	W	W	Stone.
Wayne	W	W	Sand and gravel, stone.
Wells	W	W	Stone, sand and gravel, peat.
White	W	W	Stone.
Whitley	W	W	Sand and gravel.
Undistributed [2]	[r]$218,430	180,039	
Total [3]	[r]$281,521	322,608	

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed".

[1] The following counties are not listed because no production was reported: Floyd, Ohio, Tipton, and Vanderburgh.

[2] Includes value of petroleum, natural gas and mineral production that is not assigned to specific counties plus values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Indiana business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ... thousands	2,171.0	2,224.4	+2.5
Unemployment ... do	121.6	109.4	−10.0
Employment:			
Manufacturing ... do	683.3	708.3	+3.7
Construction ... do	76.5	81.6	+6.7
Mining ... do	6.7	6.9	+3.0
Transportation and public utilities ... do	100.7	100.9	+0.2
Wholesale and retail trade ... do	371.0	386.5	+4.2
Finance, insurance, and real estate ... do	77.3	80.4	+4.0
Services ... do	229.5	241.8	+5.4
Government ... do	296.3	301.2	+1.7
Personal income:			
Total ... millions	$21,120	$23,235	+10.0
Per capita	$4,027	$4,391	+9.0
Construction activity:			
Building permits:			
Value of authorized nonresidential construction ... millions	$270.5	$278.3	+2.9
Number of private and public residential units authorized	38,028	34,726	−8.7
State highway commission contracts awarded ... millions	$151.0	[e] $150.0	−0.7
Portland cement shipments to and within Indiana thousand short tons	1,727	1,793	+3.8
Farm marketing receipts ... millions	$1,742.1	$1,960.7	+12.5
Mineral production value ... do	[r] $281.5	$322.6	+14.6

[e] Estimate. [p] Preliminary. [r] Revised.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

amends IC 1971, Title 13, by adding a new article (article 7) to provide for creation of an 11-member Environmental Management Board to develop regulations, set priorities and coordinate antipollution activities of State agencies; specifies acts of pollution which are prohibited; and sets civil and criminal penalties for acts of environmental pollution including daily fines for continuing violations.

2. Senate Bill 278, Public Law 98, amends IC 1971, 13–1, by adding a new chapter (10) to provide for filing of environmental impact statements on major projects of State agencies, and establishes an environmental policy for the State.

3. House Bill 1108, Public Law 97, amends IC 1971, 13–1–5.5–2.3, to limit phosphorus content of detergents sold or used in Indiana to 8.7%, retroactive to Jan. 1, 1972; totally bans detergents containing phosphorus as of Jan. 1, 1973, except that the ban shall not apply until after April 30, 1973, to detergents manufactured for use in machine dishwashers, etc., or any use in which the detergent runoff is arrested from reaching the natural environment.

4. Senate Bill 128, Public Law 177, amends IC 1971, 22–11 by adding a new

chapter (9.5) entitled "Elevator Safety Law of 1972," which rewrites law dealing with freight and passenger elevators, moving stairways and manlifts; sets inspection and construction fees; establishes penalties for violations; creates a Bureau of Elevator Safety; and sets duties.

5. Senate Bill 238, Public Law 45, amends IC 1971, 5-17-3-1, requiring the purchase of Indiana-mined coal for State-supported institutions, to allow purchase of out-of-state coal in the event low-sulfur coal is required by Federal regulations.

The Land Reclamation Task Force, comprised of Indiana Legislators, voted to recommend to the State Budget Committee that the petroleum severance tax law be repealed and that the Indiana Geological Survey, recipient of the declining severance tax revenues, be funded from the State's General Fund.

The Lake County Planning Commission won a suit against three men accused of excavating property without a county-issued permit. The men contended they were entitled to excavate soil from the property under an Indiana law that gives the State sole jurisdiction in mineral mining matters. The Lake County Superior Court ruled that soil or earth removed from and located upon defendants' real estate was not a mineral resource.

The Indiana Geological Survey published Bulletin 46, "Applied Geology of Industrial Limestone and Dolomite," in June. The following Survey publications were revised: "Directory of Clay and Shale Producers and Ceramic Plants in Indiana"; "Directory of Crushed Stone, Ground Limestone, Cement and Lime Producers in Indiana"; Map 11, "Locations of Crushed Stone Operations in Indiana"; and Map 14, "Locations of Clay and Shale Operations in Indiana".

Employment and Injuries.—One fatality, caused by falling rock, occurred in an underground coal mine in November. There were no fatalities in strip coal mines that were chargeable to the mining industry, however, there were several attributed to natural causes.

The two underground gypsum mines were cited in the Annual Report of the Indiana Bureau of Mines and Mining for a remarkable safety record. Peabody Coal Co. announced an expenditure of $25 million in the next 5 years for safety programs alone.

Western Indiana Aggregates, Inc., Eagle Gravel plant at Lafayette was the winner of the National Sand and Gravel Association's 1972 safety contest Class D competition for plants producing from 170,000 to 224,999 tons. Martin Marietta Aggregates' South Terre Haute plant won the Class E competition for plants producing from 60,000 to 169,999 tons. Certificates of Achievement in Safety were awarded to contestants who operated in 1972 without lost-time accidents as follows: Class B (550,000 tons to 1.5 million tons) Interstate Sand and Gravel Co., Interstate plant; Class C (225,000 to 549,999 tons) Interstate Sand and Gravel Co., Neal gravel plant; South Bend Sand and Gravel Corp., South Bend plant; Martin Marietta Aggregates, North Terre Haute plant; and three Western Indiana Aggregates, Inc. plants—Lafayette, Montezuma, and South Bend; Class D, Martin Marietta Aggregates, Clinton plant; and Class E (60,000 to 169,999 tons) Western Indiana Aggregates' portable plant at Lafayette. Special certificates were awarded to Interstate Sand and Gravel Co. for a 12-year accident-free record at its Neal gravel plant and Western Indiana Aggregates for five consecutive years without a lost-time accident. In the annual nationwide contest 280 plants were enrolled by 112 companies.

Meshberger Stone, Inc. quarry at Columbus received a Gold Bar Award in the National Crushed Stone Association 47th Annual Safety Contest for 9 consecutive years without a lost-time injury.

Louisville Cement Co.'s Logansport plant received the Portland Cement Association's (PCA) Sixth Safety Trophy Reaward for seven consecutive years without a lost-time accident. Lone Star Industries, Inc.'s Greencastle plant received a Seventeenth Safety Trophy Reaward for 18 safe years (not consecutive) and Louisville Cement Co.'s Speed plant received a third Safety Trophy Reaward for 4 safe years.

Indiana had 27 limestone quarries with crushing plants competing in the nationwide annual safety contest conducted by the U.S. Bureau of Mines in cooperation with the National Limestone Institute. Contestants who operated throughout 1972 without a disabling work injury were awarded Certificates of Achievement in Safety as follows:

Class III, working 20,001 to 60,000 man-hours—Ohio and Indiana Stone Corp., Greencastle quarry; Meshberger Stone, Inc., Columbus quarry; Western Indiana Aggregates Inc., Francisville quarry; France Stone Co., Keeport quarry; New Point Stone Co., New Port quarry; Berry Materials Corp., North Vernon quarry; Clayton Winders and Sons, Spencer quarry; DeBolt Concrete Inc., Middleboro quarry; Class IV, working 10,001 to 20,000 man-hours—Mill Creek Stone and Gravel Corp., limestone quarry; H. and R. Stone Co., Ridgeville quarry; Western Indiana Aggregates Inc., Ward quarry; New Point Stone Co., Napolean quarry; and May Stone and Sand, Inc., Woodburn quarry; and Class V, Kixmiller Brothers Inc., Freelandville quarry.

Environmental.—The minerals industry in Indiana was greatly influenced by public concern for preservation of the environment. To comply with Federal, State, and local pollution control standards and regulations, and in some instances court orders, millions of dollars were spent by the minerals industry of Indiana to improve dust-collecting facilities and treat waste-water effluent.

The Division of Reclamation issued permits for surface mining of 4,410 acres of land, of which 98% was for coal-strip mining and the remainder for clay and shale pits. The permits require reclamation of the land for the following uses: 352 acres of forest land with a maximum grade of 33⅓%; 3,124 acres of range land with the same maximum grade; 525 acres of pasture land with a maximum grade of 25%; and 409 acres of row crop land with a maximum grade of 8%.

Governor Whitcomb signed three ordinances adopted by the Indiana Air Pollution Control Board: APC–13, establishing standards for stack emissions of sulfur dioxide; APC–15, governing emissions of hydrocarbons from chemical plants and refineries; and APC–16, regulating carbon monoxide emissions. The governor refused to sign APC–17, which would set standards for nitrogen emissions from industrial plants, because it was not possible to measure such emissions accurately under present technology.

Legal action was planned against the Virginia-Kentucky Corp. for failing to comply with the 1967 Indiana Surface Mining Law. In strip mining 13 acres, the Virginia-based company allegedly exceeded the acreage allowed by permit and subsequently failed to perform reclamation work at the site. Peabody Coal Co. was ordered to reclaim its Universal mine to row crop use. Spoil must be graded to slopes of less than 8% to meet row crop use standards. The company wanted to reclaim the land for pasture and hay use, which can have slopes up to a maximum of 25%.

Peabody Coal Co. continued to reclaim more land than it mined. The program included grading, seeding, tree planting, dam building for lakes, pasture development, and an extensive test planting program to develop improved methods. On strip-mined land owned by Peabody Coal Co. in the Terre Haute area promotors plan a 300-acre recreation complex including racing tracks for horses, autos, and motorcycles. Meadowlark Farms, Inc. a subsidiary of AMAX Coal Co., operated a successful farming program on company land both before and after mining. The company restored land to agriculture and related uses at the same annual rate as it was mined.

When Senate Bill 100 was signed into law on February 16, it created an Environmental Management Board to coordinate antipollution activities of the State agencies. The Board took over many functions of the Indiana Stream Pollution Control Board.

Instead of polluting water, the pickling acid at United States Steel Corp's Gary Works will be used to purify water. K. A. Steel Chemicals, Inc., will build, own, and operate a processing plant at the Gary Works to convert the pickling acid to ferric chloride, which is used as a catalyst in water and waste water treatment plants for solid-liquid separation.

A Lake County Superior Court judge ordered United States Steel Corp. to commit itself to air pollution control at its coke plant in Gary by July 1, 1972, and complete the facility by July 1, 1977. The ruling upholds a Gary air pollution control ordinance requiring an abatement program on the part of the steel company. When the ordinance went into effect in December 1970, the company filed appeals and did not file an abatement program with the city until mid-1972. Planned expenditures at the plant, estimated at $80 million over a 5-year period, will include construction of a new battery of smokeless coke ovens costing $55 million and renovation of old batteries at a cost of $25 million. Universal Atlas Cement Division of United States Steel Corp. was operating its cement plant at Gary under a variance from the air pollution control standards. A U.S. District Court judge fined United States Steel Corp. for two counts of depositing refuse in navigable waters and rebuked the company for taking a legalistic approach to the area's pollution problem. Youngstown Sheet and Tube Co. of East Chicago was fined $500 on the same charge.

Standard Oil Co. (Indiana) announced that the company spends $30 million a year on environment-related projects, and more than $3 million on air and water conservation research.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives.—Although whetstones produced from sandstone quarried near Orleans, Orange County, doubled in quantity, the value increased only 16%. Hindostan Whetstone Co. was the State's only producer.

Cement.—Portland cement shipments, comprising 85% of the State's cement output, decreased 150,000 tons below the 1971 shipments, and the value declined 3%. The average mill value of portland cement for all types was $19.11 a ton in Indiana, an increase of 59 cents a ton. This was slightly below the $20.37 average for the United States.

In 1972 the short ton replaced the barrel as the unit of measure for production and shipments of hydraulic cement. To convert 376-pound (portland cement) barrels to tons, divide the number of barrels by 5.31915. To convert 280-pound masonry cement) barrels to short tons, divide the number of barrels by 7.14286.

Four companies operated two wet process and three dry process plants with a combined annual capacity of 2.6 million tons. At Speed, Clark County, Louisville Cement Co. was replacing three old kilns with one new dry process kiln 13-foot diameter by 15-foot diameter by 500 feet long. Clinker production capacity will be increased by 197,000 tons to a total of 1,109,000 tons when the project is completed in the first quarter of 1973. The company operated another plant at Logansport in Cass County. Lone Star Industries, Inc., produced cement at its Greencastle plant in Putnam County, and Lehigh Portland Cement Co. operated its Mitchell plant in Lawrence County. In addition to producing portland cement, Universal Atlas Cement Division of United States Steel Corp. manufactured calcium aluminate cement.

Type I (general construction use) and Type II (moderately low heat and moderate degree of resistance to sulfate attack) comprised 92% of the portland cement shipped; 6% was Type III (high-early-strength); and the remainder was expansive and portland blast furnace slag cement.

Disposition of portland cement shipped by Indiana manufacturers was as follows: 65% went to ready-mix concrete producers; 15% to highway contractors; 14% to concrete product manufacturers for concrete blocks, concrete pipes, precast prestressed concrete, and other concrete products; 4% to building material dealers; and the remainder to other contractors and for miscellaneous uses. Apparent consumption of portland cement in Indiana during 1972 was 1,790,000 tons, an increase of 3%. More than 680,000 tons of cement produced in Indiana was shipped to customers in nearby States. Nevertheless, despite abundant cement production, some Indiana customers received cement produced in other States. Shipments of portland cement were 93% in bulk and the remainder in bags. About 78% of the cement was transported by truck and the remainder by rail including movement of cement from plants to distribution terminals. Railroads hauled most of the cement from plants to terminals.

Masonry cement was manufactured at four of the five plants; Lehigh did not produce masonry cement. Shipments increased 12% in quantity and 25% in value. The average mill value of masonry cement increased $2.53 a ton to $24.33. Consumption of masonry cement in Indiana was 114,681 tons, an increase of 8%. More than two-thirds of the State's masonry cement production went to customers in other States.

Clays.—Common clay and shale production increased 7% in quantity and value. Twenty-nine companies operated 35 mines in 20 counties. A small quantity of fire clay was produced in Dubois County. Six companies produced 71% of the State's clay and shale: Hydraulic-Press Brick Co. in Morgan County; Log Cabin Coal Co. in Clay County; Louisville Cement Co. in Cass and Clark Counties; S. L. Turner Coal and Clay Co. in Parke County; General Shale Products Corp. in Morgan County; and American Brick Co. in Lake County. About 70% of the clay output came from Morgan, Clay, Clark, and Parke Counties, with 31% from Morgan County alone.

About 44% of all production was used to manufacture building bricks; 28% was used in making portland cement; and the remainder was used for lightweight aggregate, sewer pipe, drain tile, ceramic tile, and other ceramic uses. Fire clay was used in making refractory bricks.

Competition from plastic drain tubing caused a decline in the production and use of clay drain tile. Krick Tyndall Co., subsidiary of Hancock Brick and Tile Co., ceased operations in Adams County.

Brown Coal and Clay Co. sold its pit in Clay County to E & E Coal Co. in January.

Shortage of propane gas curtailed brick production in Morgan County during the last 3 months of 1972. Natural gas was used normally, and propane used as a standby fuel during natural gas curtailment.

Gypsum.—Indiana continued to rank sixth in the Nation in crude gypsum production. Production was up 20% and the value increased 13%. United States Gypsum Co. and National Gypsum Co. operated the two largest underground gypsum mines in the United States near Shoals, Martin County, and calcined gypsum at plants adjacent to the mines. National Gypsum Co.'s mine at Shoals was the fourth largest gypsum mine in the Nation, and United States Gypsum Co.'s mine was seventh. (The three largest gypsum mines in the U.S. were surface mines.) United States Gypsum Co. also operated a calcining plant near East Chicago, Lake County, on crude gypsum mined in Michigan and brought by water transportation.

Calcined gypsum production increased 18% in quantity and 23% in value. The major use of calcined gypsum was for building purposes, mainly in the manufacture of wallboard including Type X (a special fire-retardant) lath, and sheathing, and in smaller quantities for basecoat plasters.

Crude gypsum and a mixture of anhydrite and gypsum were sold for use as cement retarder. Uncalcined gypsum was also sold as land plaster for agricultural use.

Lime.—Lime production in Indiana, ranking 12th in the United States, increased 17% in quantity and 11% in value and surpassed the 1970 record. Marblehead Lime Co. produced quicklime in the State's only plant at Buffington, Lake County. Limestone quarried in northern Michigan was transported by lake freighters to Buffington and processed in rotary kilns. Output from the Buffington plant was the third largest in the United States.

Indiana ranked fifth in the Nation as a lime consumer, using 1,533,904 tons of lime. Although some lime produced in Indiana was shipped to customers in Illinois, Ohio, and Iowa, large quantities were shipped

Table 4.—Indiana: Clays sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Year	Fire clay		Common clay		Total[1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1968	182	340	1,369	2,015	1,550	2,355
1969	166	314	1,317	1,950	1,483	2,264
1970	75	202	1,259	1,936	1,335	2,139
1971	[2] 1	[2] 5	1,324	2,308	1,325	2,308
1972	W	W	1,419	2,462	[3] 1,419	[3] 2,465

W Withheld to avoid disclosing individual company confidential data.

[1] Data may not add to totals shown because of independent rounding.

[2] Includes a small quantity of kaolin.

[3] Excludes fire clay and includes a small quantity of ball clay.

into the State from producers in Illinois, Ohio, and Missouri. Most of Indiana's lime was used by the steel industry in basic oxygen furnaces (BOF), open hearth furnaces, and electric arc furnaces; however, a small quantity was used for water purification.

Marblehead Lime Co. completed installation of two new rotary kilns at its Buffington plant bringing the total to five kilns. The plant's annual capacity was increased from nearly 500,000 to more than 800,000 tons making it one of the world's largest lime plants. The additional output will serve the requirements of United States Steel Corp.'s Chicago district plants, which require ground lime in addition to pebble lime for use in their new steel-making process known as Q–BOP.

Inland Steel Co. planned to construct a lime calcining plant at its Indiana Harbor Works in Lake County. The facility will have a daily production capacity of 1,200 tons of lime when completed in January 1974. The major equipment will comprise two 600-ton-per-day rotary kilns equipped with preheater systems and contact coolers. Most of the lime plant output will serve the requirement of a BOF shop under construction by the company.

Perlite.—Crude perlite mined in New Mexico was expanded at six plants: United States Gypsum Co. at gypsum plants in Lake and Martin Counties; National Gypsum Co. at its gypsum plant in Martin County; Grefco, Inc., near Crawfordsville, Montgomery County; Airlite Processing Corp. near Scottsburg, Scott County; and Chemrock Corp. near Lafayette, Tippecanoe County. Expanded perlite production increased 125% in quantity and 110% in value. The principal uses for perlite expanded in Indiana were for plaster aggregate and as a filter aid. Smaller quantities were used for concrete aggregate and insulation.

Sand and Gravel.—Production of sand and gravel increased 12% in quantity and 14% in value. Sand and gravel was produced in 67 counties by 129 commercial operators at 180 locations, and 30 governmental agencies operated an additional 30 pits. More than 95% of the material was processed in washing or screening plants. Sand and gravel was processed at 135 stationary plants, 80 portable plants, and 25 dredging units. Of the total production, 56% was gravel.

Production ranged from less than 1,000 tons in one county to 3.1 million tons in another county. Only three commercial operations produced 1 million tons or more each; six, between 500,000 and 1 million tons each; 27, between 200,000 and 500,000 tons each; 41, between 100,000 and 200,000 tons each; 51, between 25,000 and 100,000 tons each; and 53 less than 25,000 tons. Thirty-four individual operations produced 64% of the output while 145 operations accounted for only 36% of the total output.

Sand and gravel production exceeded 1 million tons in six counties—Hamilton, Madison, Marion, St. Joseph, Switzerland and Tippecanoe. American Aggregates Corp., Irving Materials, Inc., and Martin Marietta Aggregates were the largest producers. Trucks hauled 93% of the commercially produced sand and gravel; 4% was transported by barge; and the remainder by rail.

Nearly 55% of Indiana's sand and gravel was used for paving roads; 34% was used by the building industry; 8% for fill material; and the remainder for railroad ballast and ground and unground industrial uses such as molding and glass manufacturing.

American Aggregates Corp. exposed limestone and dolomite deposits beneath its sand and gravel deposit at the South Indianapolis operation in a sufficient amount to allow limited stone production. By using limestone as a source of coarse aggregates the company will be able to recover surplus sand that was wasted in the past in the course of the desanding operation. Utilization of an underlying limestone and dolomite deposit has already increased the reserve life of the company's North Indianapolis operation.

In September the Ottawa Silica Co. of Illinois acquired Indiana Glass Sand Co. near Elizabeth, Harrison County. The name was changed to Ohio River Silica Co. The Sturm and Dillard Gravel Co. ceased operations near Syracuse, Kosciusko County. Engineering Aggregates Corp. acquired the H and S Industries' Logansport quarry in Cass County and now operates two quarries in the area.

One of the world's largest hydraulic powered backhoes was acquired by Samocki Bros. Construction Co. at Gary for exca-

Table 5.—Indiana: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,816	3,928	4,678	5,144
Fill	854	615	984	780
Paving	5,144	5,446	6,064	6,853
Other uses [1]	551	1,728	541	1,806
Total [2]	10,366	11,719	12,268	14,584
Gravel:				
Building	3,843	5,227	4,621	5,935
Fill	1,182	935	1,110	956
Paving	7,666	9,782	8,127	10,289
Miscellaneous	W	W	470	519
Other uses [3]	632	663	60	64
Total [2]	13,324	16,607	14,390	17,764
Government-and-contractor operations:				
Sand:				
Fill	23	22	6	6
Paving	76	58	133	130
Other uses	--	--	7	7
Total [2]	99	81	147	143
Gravel:				
Building	205	161	126	117
Fill	73	32	68	15
Paving	854	431	964	662
Other uses	60	62	21	5
Total [2]	1,194	686	1,179	800
Total sand and gravel [2]	24,982	29,094	27,978	33,290

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."

[1] Includes engine (1971), fire or furnace (1971), railroad ballast (1971), glass, molding, and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast and other gravel.

vating sand and gravel. The unit has a 4-cubic-yard bucket.

Slag.—About 3.8 million tons of blast furnace slag and 3 million tons of steel furnace slag were produced in Lake and Porter Counties as waste from pig iron production and steel refining. Slag produced in Illinois was shipped into Indiana for processing. Processed slag was either used in manufacturing cement, marketed for mineral wool, roofing granules, concrete aggregate, bituminous aggregate for macadam, road base material, and railroad ballast or expanded for lightweight aggregate.

Stone.—Output of stone, comprising mostly crushed limestone and dolomite, increased 5% in quantity and 6% in value. Stone was mined by 97 companies at 134 quarries in 58 counties. Ten companies mined 58% of the output at 34 quarries. Two quarries had an output exceeding 1 million tons each; 14, between 500,000 and 900,000 tons each; 56, between 100,000 and 499,000 tons each; and 64 less than 100,000 tons each, of which 44 produced less than 25,000 tons. Ralph Rogers & Co., Mulzer Crushed Stone Co., and France Stone Co. were the largest producers of crushed limestone and dolomite. Nine companies mined 26,137 tons of marl from quarries in Elkart, Lagrange, La Porte, Marshall, St. Joseph, and Steuben Counties. Three companies quarried 5,282 tons of sandstone in Lawrence, Monroe, and Morgan Counties.

Despite the small tonnage output, the value of dimension stone was 19% of the total Indiana stone production. Indiana limestone quarried from the geologic formation named the Salem Limestone has dominated the dimension limestone market in the United States for a century. It has lost steadily in its share of the construction market to other building materials such as concrete, glass, and metal. During the last 5 months of the year Indiana Limestone Co., Inc. operated its fabricating plants on

Table 6.—Indiana: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Allen	6	1,117	1,137	6	936	1,000
Bartholomew	--	60	60	1	263	252
Cass	2	W	W	2	164	167
Clinton	2	W	W	1	13	13
Dearborn	3	264	368	3	W	W
De Kalb	5	379	368	3	W	W
Delaware	2	375	337	4	W	W
Dubois	1	(1)	1	--	--	--
Elkhart	19	486	568	14	630	646
Fountain	3	W	W	3	397	503
Franklin	3	60	9	1	60	9
Fulton	2	W	163	2	211	249
Gibson	--	W	40	1	27	31
Greene	3	338	349	2	W	W
Hamilton	5	2,322	3,092	5	W	W
Hancock	2	W	W	3	84	83
Harrison	3	373	W	3	350	W
Jackson	4	420	425	2	W	W
Jay	1	26	28	1	W	45
Jefferson	--	12	5	1	4	4
Jennings	2	4	(1)	--	--	--
Knox	5	621	548	5	578	501
Kosciusko	4	763	W	5	694	509
Lagrange	6	W	W	5	281	248
Lake	3	W	W	3	344	388
La Porte	2	W	W	4	760	1,134
Madison	4	633	758	10	W	W
Marshall	5	513	W	2	W	W
Miami	4	522	W	2	W	W
Montgomery	2	77	46	5	76	48
Morgan	4	W	W	4	704	792
Noble	7	379	327	7	416	389
Perry	1	11	11	1	11	11
Randolph	1	W	W	2	103	68
Ripley	--	--	--	1	(1)	(1)
Rush	1	W	W	3	49	40
St. Joseph	7	937	925	6	1,055	932
Shelby	6	414	459	5	558	698
Starke	4	W	W	1	13	13
Steuben	7	328	375	4	184	W
Sullivan	3	117	W	4	W	W
Switzerland	1	1,016	W	1	1,164	W
Tippecanoe	4	W	W	5	1,035	1,110
Union	--	19	8	1	12	4
Vermillion	4	368	441	4	W	W
Wabash	3	48	32	2	W	W
Warren	4	786	W	3	625	W
Wayne	5	545	497	4	W	W
Wells	1	W	W	1	29	23
Undistributed [2]	r 48	10,648	17,725	52	16,150	23,380
Total [3]	r 214	24,982	29,094	210	27,978	33,290

r Revised. W Withheld to avoid disclosing individual company confidential data, included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Adams, Benton (1971), Blackford (1971), Boone, Brown (1971), Carroll, Clark, Daviess, Fayette, Grant, Hendricks, Henry, Howard, Huntington, Jasper, Johnson, Marion, Owen, Parke, Posey, Putnam, Vigo and Whitley Counties, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

a one-shift, 4-day-week basis. Dimension limestone was produced by 15 companies at 17 quarries in Franklin, Lawrence, Monroe, and Rush Counties. Victor Oolitic Stone Co. and Indiana Limestone Co. were the largest producers with operations in Monroe and Lawrence Counties. Three companies produced dimension sandstone in Lawrence, Monroe, and Morgan Counties. Production and value of all dimension stone were slightly lower than that of 1971.

Principal uses for Indiana's stone output were as follows: 63% for road base and paving materials; 14% for concrete aggregate; 12% for manufacturing portland cement; 6% for agricultural uses; and the remainder for railroad ballast, riprap and jettystone, rough and dressed architectural dimension stone, and miscellaneous chemical and industrial uses.

Table 7.—Indiana: Limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension:				
Rough architectural ....thousand cubic feet..	2,769	4,429	2,187	3,820
Irregular shaped stone	(1)	2	W	W
Flagging ....thousand cubic feet..	33	W	85	67
Cut ....do....	345	2,837	377	3,474
House stone veneer ....do....	420	851	523	990
Sawed stone	W	W	W	W
Total ....thousand short tons..	300	9,753	257	9,532
Crushed and broken:				
Bituminous aggregate	2,146	3,485	2,029	3,251
Concrete aggregate	3,766	5,814	3,721	5,814
Dense graded road base stone	7,842	11,590	8,186	12,655
Macadam aggregate	1,837	2,748	2,038	3,050
Surface treatment aggregate	1,214	1,862	943	1,612
Unspecified aggregate and roadstone	3,209	4,943	3,828	5,972
Agricultural purposes [2]	1,845	3,270	1,527	2,828
Cement	3,016	2,695	3,308	3,250
Flux	29	46	W	W
Railroad ballast	459	645	463	670
Riprap and jetty stone	248	767	160	290
Other uses [3]	287	433	778	1,280
Total [4]	25,899	38,298	26,980	40,672
Grand total [4]	26,199	48,051	27,238	50,204

W Withheld to avoid disclosing individual company confidential data; included with "Total."

[1] Less than ½ unit; included in "Total."

[2] Includes agricultural limestone, agricultural marl and other soil conditioners, and poultry grit and mineral food.

[3] Includes stone used for asphalt filler, mine dusting, building products (1971), fill, stone sand (1972), and unspecified uses.

[4] Data may not add to totals shown because of independent rounding.

Table 8.—Indiana: Limestone and dolomite sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971		1972		Type of stone produced in 1972
	Quantity	Value	Quantity	Value	
Adams	W	W	W	W	Crushed.
Allen	W	W	W	W	Do.
Bartholomew	W	W	W	W	Do.
Blackford	W	W	W	W	Do.
Carroll	W	W	W	W	Do.
Cass	W	W	W	W	Do.
Clark	2,318	2,794	2,414	3,046	Do.
Crawford	W	W	W	W	Do.
Decatur	W	W	W	W	Do.
Delaware	W	W	W	W	Do.
Fayette	--	--	2	4	Do.
Franklin	W	W	W	W	Dimension.
Grant	W	W	W	W	Crushed.
Hamilton	1,269	2,123	1,460	2,481	Do.
Harrison	W	W	W	W	Do.
Howard	W	W	W	W	Do.
Huntington	W	W	W	W	Do.
Jasper	W	W	W	W	Do.
Jay	136	W	W	W	Do.
Jennings	W	W	W	W	Do.
Lawrence	2,495	6,849	2,270	6,962	Dimension and crushed.
Madison	W	W	W	W	Crushed.
Marion	W	W	W	W	Do.
Miami	51	W	W	W	Do.
Monroe	W	7,219	W	7,103	Dimension and crushed.
Morgan	W	W	W	W	Crushed.
Newton	W	W	W	W	Do.
Orange	648	923	692	999	Do.
Owen	W	W	W	W	Do.
Perry	W	W	W	W	Do.
Pike	W	W	W	W	Do.
Pulaski	W	W	W	W	Do.

See footnote at end of table.

Table 8.—Indiana: Limestone and dolomite sold or used by producers, by county—Continued

(Thousand short tons and thousand dollars)

County	1971		1972		Type of stone produced in 1972
	Quantity	Value	Quantity	Value	
Putnam	2,774	4,060	2,861	4,094	Crushed.
Randolph	W	W	W	W	Do.
Ripley	W	W	W	W	Do.
Rush	W	W	W	W	Dimension and crushed.
Scott	W	W	W	W	Crushed.
Shelby	W	W	W	W	Do.
Sullivan	15	40	11	30	Do.
Switzerland	--	--	63	115	Do.
Vigo	W	W	W	W	Do.
Wabash	W	W	W	W	Do.
Warrick	W	W	14	44	Do.
Washington	W	W	W	W	Do.
Wayne	W	W	180	297	Do.
Wells	W	W	W	W	Do.
White	W	W	W	W	Do.
Total	26,199	48,051	27,238	50,204	

W Withheld to avoid disclosing individual company confidential data; included in "Total."

Table 9.—Indiana: Calcareous marl production

Year	Number of producers	Short tons	Value
1968	13	35,828	$28,311
1969	12	31,671	30,190
1970	12	23,208	23,436
1971	12	29,074	26,095
1972	9	26,137	24,171

Berry Materials Corp. ceased operations at its Versailles quarry and reactivated the Old Cord Stone quarry about half a mile south of the Versailles quarry in Ripley County. France Stone Co. acquired the May Stone and Sand, Inc., operations in Allen County. In January, Empire Resources International, Tulsa, Okla. purchased the Radcliff, Inc., quarry near Orleans, Orange County.

Sulfur.—Using the Mathieson-Fluor process, American Oil Co., (Amoco) recovered byproduct sulfur from crude petroleum at its Whiting refinery in Lake County. Early in the year Cities Service Oil Co. started operation of new sulfur removal and recovery facilities at its East Chicago refinery in Lake County. The new unit has a daily capacity of 50 tons of sulfur removed from refinery fuel gases, light hydrocarbon liquids, and distillate fuel oils. New equipment in the $3.5 million facility comprise a sulfur recovery unit, an amine absorption system, and a distillate hydrotreater. The distillate hydrotreater removes about 90% of the sulfur compounds from 9,000 barrels a day of distillate fuel oil product. In late December Cities Service suspended refinery operations. Atlantic Richfield Co. recovered sulfur at its refinery in Lake County.

Sales of elemental sulfur increased 111% in quantity and 146% in value.

MINERAL FUELS

Coal (Bituminous).—Ranking seventh in the United States, Indiana's coal production increased 21% in quantity and 31% in value. The average price increased 40 cents a ton to $5.58 for all coal mined in the State. The price of strip mine coal increased to $5.51 a ton and the price of underground coal rose slightly to $6.62 a ton. Production of underground coal decreased 18% as a result of the abandonment of the Thunderbird mine, Indiana's largest underground mine, operated by AMAX Coal Corp. in Sullivan County on May 26, 1972. About 94% of the coal was produced at 36 strip mines by 26 companies in nine counties; the remainder was mined in four underground mines. The largest underground mine, operated by Kings Station Coal Co. in Gibson County, produced 950,493 tons during the year. About 34% of the coal was mined in Warrick County. Peabody Coal Co. was the State's largest producer followed by AMAX Coal Co. and Enos Coal Corp.

Overburden at strip mines ranged in thickness from 15 to 97 feet. The thickness of the strip coal seams ranged from 24 to 57 inches with small tonnages produced from seams up to 82 inches thick. Underground mine coal seams ranged in thickness from 71 to 80 inches.

Table 10.—Indiana: Bituminous coal production by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines		Production (thousand short tons)			Value (thousands)
	Underground	Strip	Underground	Strip	Total	
Clay	--	6	--	1,290	1,290	$8,133
Fountain	--	1	--	23	23	W
Gibson	1	--	950	--	950	W
Greene	--	4	--	2,728	2,728	15,280
Parke	--	1	--	5	5	W
Pike	1	11	104	5,880	5,984	34,651
Spencer	--	3	--	284	284	941
Sullivan	1	2	306	3,198	3,504	W
Vermillion	--	1	--	2,253	2,253	W
Vigo	1	--	85	--	85	W
Warrick	--	7	--	8,893	8,893	46,707
Undistributed	--	--	--	--	--	38,977
Total	4	36	1,445	24,504	25,949	[1] 144,688

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Data does not add to total shown because of independent rounding.

Strip mine excavating equipment in operation during the year included 56 power shovels, 41 draglines, 38 frontend loaders, and 20 scrapers. The bucket capacities of the 97 power shovels and dragline excavators were as follows: 12 exceeding 50 cubic yards; 12 between 16 and 50 cubic yards; 28 between 6 and 15 cubic yards; and 45 less than 6 cubic yards. Shovels and draglines were powered, as follows: 51 electric; 41 diesel; three diesel electric; and two gasoline. The world's second largest dragline was in operation in Indiana, removing overburden. Standing 14 stories high the machine has a bucket capacity of 145 cubic yards, or 215 tons of material. The 30 electric motors have a combined rating of 18,000 horsepower. All underground coal was mechanically loaded.

About 76% of Indiana's coal production was transported by rail or water, 15% by truck, and 9% conveyed to minemouth electric power generating plants. About 12% of the coal was shipped by unit trains. During the year, 15 coal preparation plants were active.

Indiana coal consumption was 46,618,000 tons, of which 44% came from mines in the State; 24%, from West Virginia and Virginia; 14%, from western Kentucky; 13%, from Illinois; and the remainder from Pennsylvania, Montana, and Wyoming. Electric utilities used 56% of the coal consumed in the State; coke and gas plants used 30%; and the remainder was consumed for other uses. Despite the necessity to purchase coal mined in other States to meet demand, 21% of Indiana's coal production was shipped to customers in the following States: Wisconsin, 5%; Georgia and Florida, 5%; Kentucky and Michigan, 3% each; and the remainder to Illinois, Minnesota, Ohio, Iowa, and Tennessee.

Six new strip mines commenced operation in 1972: JH&L Strip in Green County; Salem Strip and Williams Bros., both in Pike County; Walker & Sons Strip and 3-States Coal Co., both in Spencer County; and W&S Coal Co. in Warrick County. Brown Coal and Clay Co. changed ownership in January and is now known as E&E Coal and Clay Co. Blanton Strip moved its operation from Greene County to Clay County and is now known as B&W Strip.

Ten strip mines were abandoned during the year: Dierdorf Coal Co. in Clay County; Harris Mining Co. and Al Lohr Coal Co., both in Greene County; Burcham Strip in Owen County; Thornberry Construction Co. on July 18 in Pike County; Prechtel and Vaal No. 1 on January 1 and Hasenour and Sternburg, both in Spencer County; River Coal Co. in Vermillion County; and Embry Coal Co. on February 18 and W and S on May 30 in Warrick County. Hoosierville in Clay County and Chapman No. 1 in Warrick County were abandoned in 1971 but not reported that year.

AMAX Coal Co. is developing the Ayrshire strip mine in Warrick County, scheduled for operation in late 1973 with an annual production capacity of 2.5 million tons.

Thirty coal mines in eight counties were closed down for 2 days in August when miners refused to cross picket lines of construction workers protesting the Federal Pay Board's refusal to approve contract terms. The strike cost miners $204,000 in lost wages and benefits, and $800,000 was lost in coal production.

Coke.—Indiana continued to rank second in coke production in the Nation. Output of coke produced at six plants increased 17%. During the year 13,788,286 tons of coal was carbonized to produce 9,191,000 tons of coke, a yield of 66.7%. About 44% of the coking coal came from West Virginia; 8%, from Kentucky; 9%, from Illinois; 5%, from Virginia; and 9%, from Pennsylvania. No coking coal was produced in Indiana. The value of coal carbonized was $15.73 a ton or $216,890,000.

The steel industry consumed 93% of the coke production for making pig iron and steel. The value of 8.6 million tons of coke used in the blast furnaces and steel producing furnaces was $204,872,000. Coke was produced by Inland Steel Co., United States Steel Corp., and Youngstown Sheet & Tube Co. in Lake County; Citizens Gas & Coke Utility in Marion County; Bethlehem Steel Corp. in Porter County; and Indiana Gas & Chemical Corp. in Vigo County. These companies also produced 899,034 tons of coke breeze for utilization at agglomeration plants and for other industrial uses.

Inland Steel Co. was replacing two 30-year-old coking batteries at its Indiana Harbor Works. The new coke oven battery will increase the daily coke-making capacity 500 tons to 2,500 tons when completed in 1974. It will be the first new battery in the world specifically designed for the preheating and pipeline charging of coal. The enclosed charging system will reduce emissions from the coking process. The company's research activities were directed at broadening the range of bituminous coal mixes for use in the new coke ovens.

United States Steel Corp. announced plans to construct a new coke oven battery at Gary to replace four older batteries. Five other batteries will also be rehabilitated. Completion was scheduled for 1973. Youngstown Sheet & Tube Co. was using raw bituminous coal to replace 7% of the coke in the blast furnace charge to reduce costs.

Peat.—Although peat moss sales decreased nearly 5,000 tons to 45,321 tons, the value increased slightly to $478,000. Production was 23,413 tons, therefore 46% of the material sold came from stockpiles. Nine companies produced peat moss from bogs in Allen, Delaware, Fulton, Grant, Marshall, Warren, and Wells Counties. A small amount of humus was produced in Marshall and Warren Counties. About 93% of the peat moss and humus was sold for soil improvement, the remainder as an ingredient for potting soils, packing flowers, and earthworm culture.

Petroleum and Natural Gas.—Production of crude petroleum in the State declined 8% in quantity and value. Total production from 4,379 wells [2] was 6,129,539 barrels of oil of which an estimated 3,086,500 barrels was produced by secondary recovery methods. Primary production declined 4% and secondary recovery decreased 12%. The price was $3.42 per barrel, the same as in the preceding year, and the total value of Indiana's crude production was $20,964,000.

Continued interest in Silurian reefs and overlying structures prompted an increase in drilling activity. Of the 410 wells drilled, 132 were exploratory, 126 were for primary development, 95 were for secondary recovery operations, and 57 were in connection with gas storage operations. The total number of wells drilled increased 7% and the total footage drilled was 19% more than in 1971. The success ratio of exploratory drilling was 9.8%, with 11 oil wells—four in Daviess County, three in Posey County, two in Vanderburgh County, and one each in Greene and Knox Counties; two gas wells, one each in Knox and Spencer Counties; and 119 dry wells. Two new oil fields, one new gas field, six new oil pools, and two extensions to existing oil pools were completed in Mississippian strata; one new gas pool and one extension to an existing oil pool were completed in Pennsylvania strata.

In June the discovery well of the new Elnora Central field in Daviess County was completed at a producing depth of 637 to 648 feet in the Ste. Genevieve Limestone (Mississippian). Daily production rate was 184 barrels. A second well was completed in the Aux Vases Formation, also Mississippian, and St. Genevieve, with initial production of 240 barrels a day. At yearend 15 producing wells were completed in the Elnora Central field at an average depth of 607 feet producing an average of 190 barrels a day.

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[2] World Oil. Feb. 15, 1973, p. 93.

Table 11.—Indiana: Crude petroleum production in 1972, by major field

Name of field	Year discovered	Area, acres	Location, county	Number of wells: Producing	Number of wells: Completed	Production (barrels)
Black River Consolidated	1950	700	Posey	NA	--	108,936
Caborn Consolidated	1940	1,870	do	NA	--	100,916
Coe, South	1961	440	Pike	NA	--	140,719
Elnora Central	1972	150	Daviess	15	15	200,555
Griffin Consolidated	1938	7,470	Gibson, Posey	NA	--	1,069,471
Heusler Consolidated	1938	2,220	Posey, Vanderburgh	NA	2	200,467
Mt. Carmel Consolidated	1941	2,220	Gibson, Knox	NA	5	130,266
Mt. Vernon Consolidated	1941	2,380	Posey	NA	3	239,974
Plummer	1969	1,180	Greene	NA	14	429,071
Springfield Consolidated	1946	2,640	Posey	NA	1	338,858
Union-Bowman Consolidated (New)	1941	15,720	Gibson, Knox, Pike	NA	7	363,847
Welborn Consolidated	1941	1,830	Posey	NA	2	196,737
Wheatonville Consolidated	1949	1,710	Gibson	NA	1	153,636
Undistributed	XX	XX		NA	55	2,456,086
Total	XX	XX		[1] 4,379	[2] 105	6,129,539

NA Not available. XX Not applicable.

[1] World Oil. Feb. 15, 1973, p. 93.

[2] Includes workovers without newly drilled footage.

Source: Petroleum Section, Indiana Geological Survey.

Table 12.—Indiana: Oil and gas wells drilled in 1972 [1]

County	Proved field wells			Exploratory wells			Total	Footage
	Oil	Gas	Dry	Oil	Gas	Dry		
Cass	--	--	--	--	--	1	1	1,022
Clay	--	--	--	--	--	8	8	10,960
Daviess	14	--	6	4	--	34	58	48,454
Dubois	--	--	1	--	--	5	6	4,983
Floyd	--	--	--	--	--	1	1	710
Gibson	12	--	9	--	--	10	31	41,478
Grant	--	--	1	--	--	--	1	1,020
Greene	13	--	--	1	--	17	31	43,654
Huntington	4	1	5	--	--	1	11	11,577
Knox	13	--	9	1	1	9	33	44,907
La Porte	--	--	--	--	--	1	1	1,608
Madison	--	--	--	--	--	1	1	3,100
Martin	--	--	--	--	--	3	3	3,520
Miami	1	--	--	--	--	--	1	882
Newton	--	1	1	--	--	--	2	1,916
Owen	--	--	--	--	--	1	1	1,492
Perry	--	1	--	--	--	--	1	461
Pike	6	--	2	--	--	3	11	14,118
Posey	11	--	10	3	--	4	28	51,002
Spencer	8	--	8	--	1	12	29	24,454
Sullivan	1	--	--	--	--	3	4	4,387
Vanderburgh	9	--	6	2	--	3	20	43,682
Wabash	2	--	1	--	--	--	3	3,118
Warrick	--	--	--	--	--	2	2	2,596
Total	[2] [3] 94	[3] 3	[3] [4] 59	11	2	[3] 119	[3] 288	365,091

[1] Does not include service wells (water input, saltwater disposal, water supply, or gas input wells). Also does not include wells drilled in connection with gas storage operations.

[2] Includes oil wells completed in secondary recovery projects.

[3] Includes workovers without newly drilled footage.

[4] Includes dry holes completed in secondary recovery projects.

Source: Petroleum Section, Indiana Geological Survey.

A well completed in the Harrodsburg Limestone in the Spencer Consolidated field in Posey County established a new record depth of 3,911 feet for oil production in Indiana. Two additional wells were completed during the year in the same field—one in the St. Louis Limestone at 3,191 feet and the other in the Salem Limestone at 3,689 feet. All three formations are Mississippian in age.

Seismic exploration and stratigraphic test drilling were conducted at an increased tempo in Daviess, Dubois, Greene, Knox, and Martin Counties. Some interest was shown in the area of the Cincinnati Arch in north central Indiana and along the Mt.

Carmel Fault in Lawrence, Monroe, Morgan, Orange, and Washington Counties.

Natural gas production decreased 34% to 355.1 million cubic feet, valued at $55,500.

Propane gas, which is used as standby fuel for industrial plants and by Indiana farmers to dry corn and soybeans was in short supply. Citizens Gas & Utility Co. was constructing a new liquefied natural gas facility at Beech Grove in Marion County with a storage capacity for liquid equivalent of 1 billion cubic feet of gas. Gas stored at a temperature of 260°F below zero can be fed into consumer gas lines in a vaporized state at the rate of 120 million cubic feet a day.

Indiana was laced by pipelines for the transmission of natural gas, crude oil, and refined petroleum products. There were 34 underground fields for natural gas storage in 23 counties.

Proved crude oil reserves at the end of 1972 were reported to be 29,383,000 barrels, and the total liquid hydrocarbon reserve was 29,397,000 barrels.[3]

Eight petroleum refineries operated during the year with a combined crude oil distillation capacity of 555,500 barrels[4] per calendar day in January. Amoco increased its Whiting refinery capacity by 40,000 barrels a day during the year, and in December Cities Service Oil Co. suspended a 56,000-barrel-per-day refinery operation at East Chicago. The yearend capacities of the seven remaining refineries are as follows in barrels per calendar day: Amoco, 305,000, Atlantic Richfield Co., 140,000, Mobil Oil Corp., 47,000 all in Lake County; Rock Island Refining Corp., 27,000 in Marion County; Indiana Farm Bureau Coop. Association, Inc., 12,500 in Posey County; Laketon Asphalt Refining, Inc., 6,000 in Wabash County; and Gladieux Refinery, Inc., 3,250 in Allen County.

In the fall Amoco began using foreign crude oil for the first time at the Whiting refinery citing a shortage of domestic crude as the reason for using crude from overseas. The Whiting refinery put several new units on stream: a 40,000-barrel-per-day Ultraformer using Amoco's patented reforming process; a large fluid-bed refinery waste incinerator; and a hydrogenation unit that uses a new proprietary high-pressure catalytic process to produce high-purity waxes and white oils. A 15,000-barrel-per-day blending oil Ultrafiner went on stream, desulfurizing internally consumed fuel oil to reduce sulfur dioxide emissions. The second phase of a modernization program for upgrading asphalt products and reducing objectionable emissions was completed.

METALS

Aluminum.—At the Warrick smelter in Evansville, the Aluminum Co. of America (Alcoa) produced aluminum ingots using alumina barged from Mobile, Ala., and Point Comfort, Tex. Production increased 19% in quantity and 3% in value. Two potlines were modernized during the year for fume control. With an annual primary smelting capacity of 275,000 tons the Warrick Works is one of the aluminum industry's largest domestic smelters. More than 300 million cans totaling more than 15 million pounds have been remelted at Alcoa's Warrick smelter since the company began its recycling program in November 1970. Used cans were shipped from many areas including Dallas, Tex., and San Diego, Calif., for recycling at the smelter.

Pig Iron and Steel.—Output of pig iron from 26 blast furnaces in Indiana was 15,335,000 tons; an increase of 20%. The value increased 32% to $1.18 billion. Inland Steel Co., United States Steel Corp., and Youngstown Sheet & Tube Co. each produced pig iron and steel in Lake County and Bethlehem Steel Corp. produced iron and steel in Porter County.

Only two other States produce more steel than the Hoosier State. Steel companies employ more people at a higher payroll with a greater value added total than any other industry in Indiana. Nevertheless, steel companies complained that imported steel continued to have a detrimental effect on the growth and vitality of the steel industry.

Steel output reported by the American Iron and Steel Institute was 21,268,000 tons,

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[3] American Gas Association, American Petroleum Institute, and Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the United States and Canada and United States Productive Capacity as of December 31, 1972. V. 27, May 1973, pp. 36 and 117.

[4] U.S. Bureau of Mines. Petroleum Refineries in the United States and Puerto Rico. Mineral Industry Surveys, Aug. 3, 1972, 15 pp.

23% greater than Indiana's 1971 production. Steel was produced in BOF shops by the four primary producers and in open-hearth furnaces by all but Bethlehem Steel Corp. Steel was also produced from scrap in electric arc furnaces.

On May 8 the *Stewart J. Cort*, largest ore carrier on the Great Lakes, completed its maiden voyage at Burns Harbor, carrying iron ore pellets. Owned by Bethlehem Steel Corp., the self-unloading vessel has a capacity of 58,300 tons and will make about 40 trips annually between Taconite Harbor, Minn., and the Burns Harbor plant.

Bethlehem Steel Corp. started operation of its second blast furnace at Burns Harbor early in the year. The new furnace, the largest in the Western Hemisphere, has a daily capacity exceeding 5,000 tons of pig iron and increased the annual capacity of the plant from 2.0 to 4.3 million tons. The company planned construction of a multi-million dollar continuous slab caster at Burns Harbor capable of producing 1.5 million tons of steel slabs annually in widths 32 through 76 inches and thicknesses from 8 to 10 inches. Completion of the two-strand machine was scheduled for the fall of 1974.

At Indiana Harbor, Inland Steel Co. established a plant production record from its eight blast furnaces in 1972 attributed to the use of oil injection and coke of higher quality. The company operated the only two-vessel BOF shop in the United States with production exceeding 4 million tons in one year. The BOF shop originally built to produce 230 tons of steel every 50 minutes produced 255 tons in a reduced "heat" time of 32 minutes. A second BOF shop designed to produce 2.2 million tons of steel annually was under construction. When completed in late 1973 the company will close down the No. 2 open hearth shop comprising 13 furnaces. An auxiliary dust collection system was added to the existing emission control facilities at the No. 3 open hearth shop. Construction of the new BOF shop's air quality control facilities was financed through the sale of $13.5 million in tax exempt revenue bonds issued by the city of East Chicago. Late in December the company began operating its first continuous slab caster.

Youngstown Sheet & Tube Co. was using bituminous coal to replace 7% of the coke in the blast furnace charge in an effort to reduce costs.

A new blast furnace was under construction by the United States Steel Corp. at its Gary plant. Completion of the No. 13 blast furnace was scheduled for 1973. Initial operations at the three-furnace basic oxygen process (Q–BOP) shop at Gary were expected to commence early in 1973. This Q–BOP installation, the world's first large-scale use of this process, was adapted through the company's research from a process invented by Maxhütte of West Germany. The company established a continuous slab caster record at the Gary Works with the casting of 22,391 tons of steel from 107 heats of BOP steel in 83 hours without stopping. The 8-mile-long slab measuring 8 inches in thickness and 34 to 55 inches in width was cut into 40-foot lengths.

Other Metals.—Antimonial lead, bismuth, gold, lead, silver, and tellurium were recovered by United States Smelting Lead Refinery, Inc., a subsidiary of United States Smelting, Refining, and Mining Co. at its electrolytic refinery in Lake County.

Table 18.—Principal producers [1]

Commodity and company	Address	Type of activity	County
Abrasive Stone: Hindostan Whetstone Co.	Box 501, Bedford, Ind. 47421	Quarry; stationary plant	Orange.
Cement:			
Lehigh Portland Cement Co.	Young Bldg., 718 Hamilton St. Allentown, Pa. 18105	Portland, dry process	Lawrence.
Lone Star Industries Inc.	2511 East 46th St., Suite K Indianapolis, Ind. 46205	Portland and masonry, wet process	Putnam.
Louisville Cement Co.	501 South 2nd St. Louisville, Ky. 40202	Portland and masonry, wet and dry process	Cass, Clark.
Universal Atlas Cement Div., United States Steel Corp.	600 Grant St., U.S. Steel Bldg. Pittsburgh, Pa. 15230	Portland and masonry, dry process	Lake.
Clays and shale:			
Adams Clay Products Co.	Box 82 Martinsville, Ind. 46151	Pits and plant	Morgan.
American Brick Co.	6558 West Fullerton Ave. Chicago, Ill. 60635	Pit and plant	Lake.
Arketex Ceramic Corp.	Box 347, Brazil, Ind. 47834	Pit and plants	Vermillion.
H. H. Bartlett	206 11th Street Huntingburg, Ind. 47542	Pit	Dubois.
Bloomfield Shale, Inc.	P.O. Box 272 Bloomfield, Ind. 47424	Pit and plant	Green.
Bloomington Crushed Stone, Inc.	P.O. Box 849 Bloomington, Ind. 47401	Pit	Lawrence.
Colonial Brick Corp.	Box 365, Cayuga, Ind. 47928	Pits and plants	Vermillion.
Comet Coal and Clay Co.	P.O. Box 11, Linton, Ind. 47451	Pit	Greene.
General Shale Products Corp.	P.O. Box 96, Mooresville, Ind. 46158	Pit and plant	Morgan.
Huntingburg Brick Co.	710 Main St. Huntingburg, Ind. 47542	do	Dubois.
Hydraulic-Press Brick Co.	705 Olive St. St. Louis, Mo. 63101	do	Morgan.
Indiana Clay Sales Inc.	Box 112, Carbon, Ind. 47837	Pits	Clay.
Indiana Drain Tile, Inc.	Brooklyn, Ind. 46111	Pit and plant	Morgan.
Inman Tile Co.	R. R. 4 Hartford City, Ind. 47348	do	Blackford.
Jackson Brick & Hollow Ware Co.	701 North Ewing St. Brownstown, Ind. 47220	do	Jackson.
The Krick-Tyndall Co., Subsidiary Hancock Brick & Tile Co.	Box 450, Findlay, Ohio 45840	do	Adams.
Lehigh Portland Cement Co.	Young Bldg., 718 Hamilton St. Allentown, Pa. 18105	Pit	Jackson.
Log Cabin Coal Co.	304 South Depot St. Brazil, Ind. 47834	Pits	Clay.
Logan Clay Products Co.	Brazil, Ind. 47834	Pit and plant	Clay, Montgomery.
Louisville Cement Co.	501 South 2nd St. Louisville, Ky. 40202	Pits	Cass, Clark.
Majenica Tile Co.	R. R. 5, Huntington Ind. 46750	Pit and plant	Huntington.
Medora Brick Co.	Medora, Ind. 47260	do	Jackson.
Mineral Resources, Inc.	Pierre LaClede Center, 7701 Forsyth Blvd. St. Louis, Mo. 63105	Pit	Martin.
S. L. Turner Coal & Clay Co., Inc.	Box 337, Carbon, Ind. 47837	do	Parke.

See footnote at end of table.

Table 13.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Coal (bituminous):			
AMAX Coal Co., Div. of American Metal Climax, Inc.:	430 Big Four Bldg. Inadianapolis, Ind. 46225		
Chinook		Strip mine; cleaning plant	Clay.
Ayrcoe		Strip mine	Pike.
Minnehaha		Strip mine; cleaning plant	Sullivan.
Thunderbird		Underground mine; cleaning plant	Do.
Wright		Strip mine	Warrick.
Chapman Coal Co.	P.O. Box 55, Petersburg, Ind. 47567	do	Pike.
Cornell Excavating, Inc	Route 4, Boonville, Ind. 47601	do	Warrick.
Enos Coal Corp., Old Ben Coal Corp.:	10 South Riverside Plaza Chicago, Ill. 60606		
Enos		Strip mine; cleaning plant	Pike.
Blackfoot No. 5		do	Do.
J. R. Coal Corp	Route 1, Chandler, Ind. 47610	Strip mine	Warrick.
Kings Station Coal Corp	10 South Riverside Plaza Chicago, Ill. 60606	Underground mine; cleaning plant	Gibson.
Lemmons & Co., Inc	535 South Second St. Boonville, Ind. 47601	Strip mine	Warrick.
Mount Pleasant Mining	Route 25, Box 19, Terre Haute, Ind. 48701	Underground mine; cleaning plant	Vigo.
Mulzer Crushed Stone Co	Box 248, Tell City, Ind. 47586	Strip mine	Spencer.
Parke Coal Co	Box 236, Petersburg, Ind. 47567	do	Pike.
Peabody Coal Co.:	301 North Memorial Dr. St. Louis, Mo. 63102		
Hawthorn		Strip mine; cleaning plant	Greene.
Latta		Strip mine; coal cleaned at Miller plant	Do.
Universal		Strip mine	Vermillion.
Miller Preparation Plant		Cleaning plant	Greene.
Dugger		Strip mine; coal cleaned at Miller plant	Sullivan.
Lynnville		Strip mine; cleaning plant	Warrick.
Squaw Creek		do	Do.
R & H Mining, Inc	Route 1, Jasper, Ind. 47546	Underground mine	Pike.
Thornberry Construction Co., Inc	Box 467, Madison, Ky., 42431	Strip mine	Do.
Coke:			
Citizens Gas & Coke Utility	2020 North Meridian Indianapolis, Ind. 46209	Coke ovens	Marion.
Indiana Gas & Chemical Corp	1341 Hulman St. Terre Haute, Ind. 47802	do	Vigo.
Inland Steel Co	3210 Watling St. East Chicago, Ind. 46312	do	Lake.
United States Steel Corp	Gary, Ind. 46400	do	Do.
The Youngstown Sheet & Tube Co	Box 900, Youngstown, Ohio 44501	do	Do.
Gypsum:			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Underground mine; calcining plant	Martin.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	Underground mine; 2 calcining plants	Lake, Martin.
Iron and Steel:			
Bethlehem Steel Corp., Burns Harbor Plant	701 East 3rd St. Bethlehem, Pa. 18016	Iron blast furnace and basic oxygen steel furnace.	Porter.

Inland Steel Co.	3210 Watling St. East Chicago, Ind. 46312	Iron blast furnaces and open-hearth steel furnaces.	Lake.
United States Steel Corp., Gary Steel Works	Gary, Ind. 46400	do	Do.
The Youngstown Sheet & Tube Co.	Box 900, Youngstown, Ohio 44501	do	Do.
Lime: Marblehead Lime Co.	300 West Washington St. Chicago, Ill. 60606	Quicklime, 3 rotary kilns	Do.
Peat:			
Herb Felger Peat Moss and Black Dirt	9912 Valentine Rd. Fort Wayne, Ind. 46808	Bog, processing plant	Allen.
Millburn Peat Co., Inc	Box 297 Otterbein, Ind. 47970	do	Warren.
Organic Products Co.	225 South Nichols Ave., Apt. 8 Muncie, Ind. 47303	do	Delaware.
Ralph Shewman	Rt. 1, Akron, Ind. 46910	do	Fulton.
Expanded perlite:			
Airlite Processing Corp	P.O. Scottsburg, Vienna, Ind. 47170	Processing plant	Scott.
Chemrock Corp	End of Osage St., Nashville, Tenn. 37208	do	Tippecanoe.
Grefco, Inc	2111 Enco Drive, Oakbrook, Ill. 60521	do	Montgomery.
National Gypsum Co.	325 Delaware Ave., Buffalo, N.Y. 14202	do	Martin.
United States Gypsum Co.	101 South Wacker Dr. Chicago, Ill. 60606	do	Lake, Martin.
Petroleum Refineries:			
American Oil Co.	2400 New York Ave., Box 710 Whiting, Ind. 46394		Lake.
Atlantic Richfield Co.	3500 Indianapolis Blvd. East Chicago, Ind. 46312		Do.
Cities Service Oil Co.	4900 Cline Ave., Box 718 East Chicago, Ind. 46312		Do.
Mobil Oil Corp.	3821 Indianapolis Blvd. East Chicago, Ind. 46312		Do.
Rock Island Refining Corp.	P.O. Box 68007, Indianapolis, Ind. 46268		Marion.
Roofing granules: H. B. Reed & Co., Inc	8149 Kennedy Ave. Highland, Ind. 46322	2 plants; produced from slag	Lake.
Sand and gravel:			
American Aggregates Corp.	Garst Ave. at Ave. B Greenville, Ohio 45331	Pits; stationary plants	Hamilton, Marion, Wayne.
Hilltop Concrete Corp.	Box 11056 Cincinnati, Ohio 45211	Pit; stationary plant	Switzerland.
Interstate Sand & Gravel Co., Inc.	Box 38, Covington, Ind. 47932	do	Warren.
Irving Materials, Inc., No. 2	Box 369, Greenfield, Ind. 46140	Pits; portable and stationary plants	Hamilton, Henry.
Martin Marietta Aggregates Div., Martin Marietta Corp.	4096 First Ave., N.E. Cedar Rapids, Iowa 52406	Pits; portable and stationary plants	Hamilton, Marion, Shelby, Vermillion, Vigo.
Neal Gravel Co., Inc., Interstate Sand & Gravel Co., Inc.	Box 38, Covington, Ind. 47932	Pit; stationary plant	Fountain.
Rieth-Riley Construction Co., Inc.	Box 566, Sturgis, Mich. 49091	Pits; portable plants	De Kalb, Elkhart, St. Joseph.
S & G Excavating, Inc.	Route 21, Box 698 Terre Haute, Ind. 47801	Pit; stationary plant	Vigo.
Spray Sand & Gravel, Inc.	Route 4, Seymour, Ind. 47274	Pits; dredges; stationary plants	Jackson.
Stonestreet Gravel Co., Inc.	R.R. 1, Angola, Ind. 46703	Pits; stationary plants	Allen, Steuben.
Western Indiana Aggregates, Inc., Medusa Portland Cement Co.:	500 North 6th Street Lafayette, Ind. 47901		
Anderson Gravel Division		Pits; stationary plant	Madison.

See footnote at end of table.

Table 13.—Principal producers[1]—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
Western Indiana Aggregates, Inc., Medusa Portland Cement Co.—Continued	500 North 6th Street Lafayette, Ind. 47901		
Eagle Materials, Inc		Dredge; stationary plant	Lake.
Hanna Sand & Gravel Co., Inc		do	La Porte.
Lafayette No. 1 Gravel Division		Pit; stationary plant	Tippecanoe.
Lafayette Portable Gravel Division		Pit; portable plant	Do.
Leesburg Gravel Division		Pit; stationary plant	Kosciusko.
Montezuma Gravel Division		do	Parke.
South Bend Gravel Division		do	St. Joseph.
Nonferrous Smelters and Refineries:			
Aluminum Company of America	Newburgh, Ind. 47630	Aluminum smelter	Warrick.
American Smelting & Refining Co	2230 Indianapolis Blvd. Whiting, Ind. 46394	Lead secondary plant	Lake.
NL Industries, Inc	Beech Grove, Ind. 46107	do	Marion.
United States Smelting Lead Refinery, Inc	5300 Kennedy Ave. East Chicago, Ind. 46312	Lead primary and secondary plant	Lake.
Stone:			
Crushed and broken:			
American Aggregates Corp	Garst Ave. at Avenue B Greenville, Ohio 45331	Quarries; stationary plants	Hamilton, Owen.
T. J. Atkins & Co	P.O. Box 529 Jeffersonville, Ind. 47130	Quarry	Clark.
Berry Materials Corp	Box 450, North Vernon, Ind. 47265	Quarries	Jennings, Ripley.
Bloomington Crushed Stone Co., Inc., Ralph Rogers & Co., Inc.	Box 849, Bloomington, Ind. 47401	Quarries; stationary plants	Lawrence, Monroe.
Cave Quarries, Inc	R. R. 3, Paoli, Ind. 47454	Quarries	Orange, Shelby.
DeBolt Concrete Co., Inc	Box 438, Richmond, Ind. 47374	Quarry	Randolph, Wayne.
Delphi Limestone Co	P.O. Box 29, Delphi, Ind. 46923	do	Carroll.
France Stone Co	Box 1928, Toledo, Ohio 43603	Quarries	Allen, Cass, Putnam.
Gorman Construction., Inc	P.O. Box 96 Russellville, Ind. 46175	Quarry	Putnam.
Irving Bros. Gravel Co., Inc.:	Rt. 3, Marion, Ind. 46952		
Erie Stone, Inc		Quarries; stationary plants	Hamilton, Huntington, Wells.
Irving Bros. Stone & Gravel		Quarry; stationary plant	Delaware.
Pipe Creek Stone Co		do	Grant.
Lehigh Portland Cement Co	Young Bldg., 718 Hamilton St. Allentown, Pa. 18105	do	Lawrence.
Lone Star Cement Corp	2511 East 46th St., Suite K Indianapolis, Ind. 46205	do	Putman.
Louisville Cement Co	501 South 2nd St. Louisville, Ky. 40202	Quarries; stationary plants	Cass, Clark.
Martin-Marietta Aggregates Central Division	Box 789 Cedar Rapids, Iowa 52406	Quarry	Clark.
Meshberger Brothers Stone Corp	P.O. Box 38 Linngrove, Ind. 46769	Quarries and plants	Adams, Bartholomew.
Midwest Aggregates Corp., Old Fort Industries, Inc.	2013 South Anthony Blvd. Fort Wayne, Ind. 46805	Quarry; stationary plant	Allen, Blackford, Delaware.
Mitchell Crushed Stone Co., Inc., Ralph Rogers & Co., Inc.	Box 849, Bloomington, Ind. 47401	do	Lawrence.
Mulzer Crushed Stone Co	Box 248, Tell City, Ind. 47586	Quarries; underground mine; stationary plants.	Crawford, Perry.

Muncie Stone and Lime Co.	Box 2525, Muncie, Ind. 47302	Quarry	Delaware.
New Point Stone Co.	R.R. No. 1, Batesville, Ind. 47006	Quarries	Decatur, Ripley.
Newton County Stone Co., Inc., Ralph Rogers & Co., Inc.	Box 147, Kentland, Ind. 47951	Quarry; stationary plant	Newton.
Scott County Stone Co., Inc.	P.O. Box 130 Scottsburg, Ind. 47170	Quarry	Scott.
Sellersburg Stone Co., Inc.	1019 East Utica St. Sellersburg, Ind. 47172	do	Clark.
Stony Creek Stone Co., Inc.	R.R. 4, Box 133A Noblesville, Ind. 46060	do	Hamilton.
Western Indiana Aggregates, Inc., Medusa Portland Cement Co., Francesville Stone Division.	500 North 6th St. Lafayette, Ind. 47901	Quarry; stationary plant	Lawrence, Monroe.
Yeoman Stone Co.	P.O. Box 2, Kokomo, Ind. 46901	Quarry	Howard.
Dimension Stone:			
Bloomington Limestone Corp.	Box 250, Bloomington, Ind. 47401	Quarry; stationary plant	Monroe.
Elliott Stone Co.	Bedford, Ind. 47421	Quarry	Do.
Evans Quarries Inc.	Box 144, Bedford, Ind. 47421	do	Lawrence.
Four R Quarries Inc.	Box 229, Fairland, Ind. 46126	do	Monroe.
Independent Limestone Co.	Route 5, Box 395 Bloomington, Ind. 47401	Quarry; stationary plant	Do.
Indiana Limestone Co., Inc.	405 North 1st St. Bedford, Ind. 46421	Quarries; stationary plants	Lawrence, Monroe.
Indiana Sandstone Co., Inc.	Box 501, Bedford, Ind. 47421	Quarry; finishing plant	Lawrence.
Piedmont Stone Co., Inc.	P.O. Box 188, Bloomington, Ind. 47401	Quarry	Do.
Reed Quarries, Inc.	Box 64, Bloomington, Ind. 47401	Quarry; stationary plant	Monroe.
Victor Oolitic Stone Co.	Box 668, Bloomington, Ind. 47401	do	Lawrence, Monroe.
Woolery Stone Co., Inc.	Box 40, Bloomington, Ind. 47401	do	Monroe.
Sulfur (recovered):			
American Oil Co.	910 South Michigan Ave. Chicago, Ill. 60680	Mathieson-Fluor process	Lake.
Atlantic Richfield Co.	3500 Indianapolis Blvd. East Chicago, Ind. 46312	Claus process	Do.

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[1] Data regarding producers of natural gas and petroleum not available.

The Mineral Industry of Iowa

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Iowa for collecting information on all minerals except fuels.

By Brinton C. Brown[1]

Iowa ranked 31st in the United States in the value of its mineral production which reached another alltime high of $134,496,000 in 1972, surpassing last year's record by 5%. Increased output of nonmetallic minerals, with the exception of lime and sand and gravel, combined with higher prices, more than offset decreased production and value of coal and peat.

Nonmetallic minerals dominated the State's mineral production, with 97% of the total value; the remaining 3% was mineral fuels comprising mostly coal. Mineral production value in the State was divided as follows: Portland cement, 37%; stone, 36%; sand and gravel, 15%; gypsum, 4%; coal, 3%; clays, 2%; masonry cement, 1%; and the remaining 2% lime, peat, and gem stones. Although petroleum has not been produced since 1963, this was the second year in which no applications were made for permits for oil tests. However, 161 drilling permits were issued during 1972: 24 for gas injection/withdrawal wells, three for observation wells associated with Iowa's five gas storage projects, and 134 for stratigraphic tests.

Natural gas deliveries were curtailed to "interruptible" customers during cold weather, which led to a run on alternate fuels —oil and propane. These fuels were also in short supply nationwide and an acute shortage developed that was responsible for closing some mineral processing plants during the winter. Farmers also had difficulty obtaining fuel for drying a huge corn crop before storage.

Legislation and Government Programs.—The following Federal legislation enacted during 1972 can affect mineral producing

Table 1.—Mineral production in Iowa[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement: Portland ....thousand short tons..	2,393	$47,925	2,458	$49,635
Masonry ....do....	66	1,719	66	1,916
Clays ....do....	[2] 1,028	[2] 1,702	1,047	2,648
Coal (bituminous) ....do....	989	4,609	851	4,138
Gem stones	W	W	NA	1
Gypsum ....thousand short tons..	1,154	4,460	1,380	5,714
Sand and gravel ....do....	18,279	20,530	17,107	20,140
Stone ....do....	[3] 25,389	[3] 44,977	27,457	48,642
Value of items that cannot be disclosed: Clay (fire) (1971), lime, peat, stone (dimension) (1971), and values indicated by symbol W ...	XX	1,899	XX	1,667
Total	XX	127,821	XX	134,496
Total 1967 constant dollars	XX	108,686	XX	[p] 111,887

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

[3] Excludes certain dimension stone; included with "Value of items that cannot be disclosed."

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operations: Public Law 92–500 (Oct. 18), Federal Water Pollution Control Act Amendments of 1972; Public Law 92–574 (Oct. 27), Environmental Noise Control Act of 1972; and Public Law 92–322 (June 30), granting Congressional consent to a 3-year extension of an interstate compact to conserve oil and gas.

In April the 64th General Assembly of Iowa passed Senate File 85, an act creating a department of environmental quality and establishing four commissions in the department—air quality, water quality, solid waste disposal, and chemical technology. The act became Chapter 455B of the Iowa Code. Rules and regulations relating to air pollution control, adopted by the Iowa Air Pollution Control Commission for the Iowa State Department of Health, became effective June 16, 1972.

A Land Use Policy Study Commission was established to conduct public hearings on whether the State should tell private land owners how to use their land, and to make recommendations to the 1973 Iowa Legislature.

In August the Atomic Energy Commission granted an interim permit to operate, at 90% capacity, the Quad-Cities Nuclear Generating Station on the Mississippi River

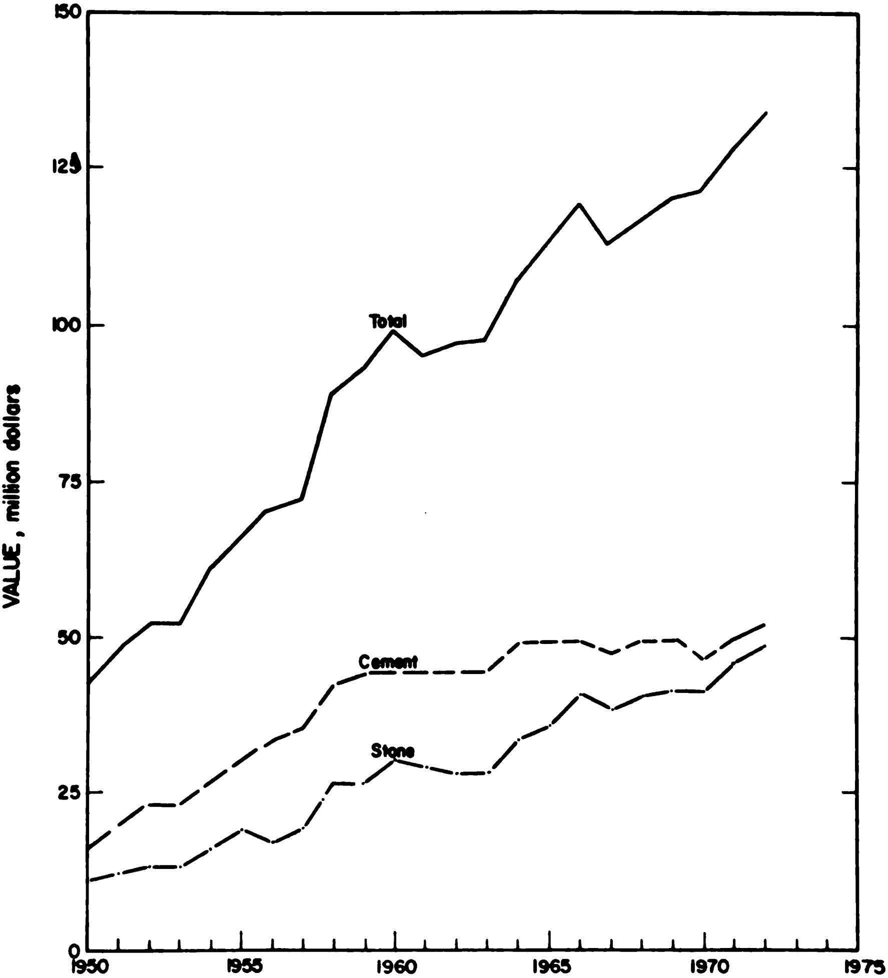

Figure 1.—Value of cement, stone, and total value of mineral production in Iowa.

Table 2.—Value of mineral production in Iowa, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adair	W	W	Stone.
Adams	W	W	Do.
Allamakee	W	$294	Stone, sand and gravel.
Appanoose	W	W	Stone, clays.
Audubon	W	W	Sand and gravel.
Benton	$165	W	Sand and gravel, stone.
Black Hawk	W	W	Stone, sand and gravel.
Boone	W	W	Sand and gravel, clays.
Bremer	814	W	Stone, sand and gravel.
Buchanan	W	W	Do.
Buena Vista	83	120	Sand and gravel.
Butler	W	530	Stone, sand and gravel.
Calhoun	54	W	Sand and gravel.
Carroll	223	W	Do.
Cass	W	W	Stone.
Cedar	W	W	Stone, sand and gravel.
Cerro Gordo	28,734	29,727	Cement, stone, clays, sand and gravel, lime.
Cherokee	W	606	Sand and gravel.
Chickasaw	W	W	Sand and gravel, stone.
Clarke	W	W	Stone.
Clay	W	W	Sand and gravel.
Clayton	657	1,098	Sand and gravel, stone.
Clinton	W	W	Stone, sand and gravel.
Crawford	W	W	Sand and gravel.
Dallas	846	W	Clays, sand and gravel, stone.
Davis	--	W	Stone, sand and gravel.
Decatur	W	W	Stone.
Delaware	206	W	Stone, sand and gravel.
Des Moines	2,424	W	Gypsum, stone, sand and gravel.
Dickinson	276	177	Sand and gravel.
Dubuque	W	W	Stone, sand and gravel.
Emmet	147	W	Sand and gravel.
Fayette	915	963	Stone, sand and gravel.
Floyd	501	W	Stone, sand and gravel, clays.
Franklin	228	W	Sand and gravel, stone, clays.
Fremont	W	W	Stone, sand and gravel.
Greene	W	W	Sand and gravel.
Grundy	W	W	Stone, sand and gravel.
Guthrie	113	W	Sand and gravel.
Hamilton	W	W	Stone, sand and gravel.
Hancock	W	869	Sand and gravel, stone.
Hardin	W	W	Stone, sand and gravel.
Harrison	714	809	Do.
Henry	139	W	Do.
Howard	W	249	Do.
Humboldt	1,367	1,281	Do.
Ida	W	--	
Iowa	W	W	Sand and gravel.
Jackson	W	W	Stone, sand and gravel.
Jasper	W	W	Sand and gravel, stone.
Jefferson	166	278	Stone.
Johnson	W	1,853	Stone, sand and gravel.
Jones	W	W	Do.
Keokuk	W	W	Stone, clays.
Kossuth	129	263	Sand and gravel.
Lee	543	626	Stone, sand and gravel.
Linn	W	3,453	Do.
Louisa	W	W	Stone.
Lucas	932	542	Coal.
Lyon	156	82	Sand and gravel.
Madison	W	W	Stone, clays.
Mahaska	2,416	2,331	Coal, stone, sand and gravel.
Marion	1,543	W	Do.
Marshall	W	W	Stone, sand and gravel.
Mills	W	W	Do.
Mitchell	659	W	Do.
Monona	413	245	Sand and gravel.
Monroe	W	1,250	Coal, sand and gravel.
Montgomery	W	W	Stone, sand and gravel.
Muscatine	W	W	Sand and gravel, stone.
O'Brien	W	W	Sand and gravel.
Osceola	241	W	Do.
Page	W	W	Stone, sand and gravel.
Palo Alto	431	W	Sand and gravel.
Plymouth	499	423	Do.

See footnotes at end of table.

Table 2.—Value of mineral production in Iowa, by county[1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Pocahontas	W	W	Stone.
Polk	$17,001	$17,658	Cement, sand and gravel, clays.
Pottawattamie	W	W	Stone, sand and gravel.
Poweshiek	W	W	Stone.
Sac	435	744	Sand and gravel.
Scott	14,919	15,696	Cement, stone, lime, clays.
Shelby	W	W	Sand and gravel.
Sioux	762	974	Do.
Story	1,125	W	Sand and gravel, stone, clays.
Tama	W	W	Sand and gravel.
Taylor	W	W	Stone.
Union	W	W	Stone, sand and gravel.
Van Buren	831	W	Do.
Wapello	477	345	Sand and gravel, stone, clays.
Warren	W	W	Sand and gravel, clays.
Washington	W	W	Stone.
Wayne	--	W	Do.
Webster	4,909	5,106	Gypsum, stone, sand and gravel, clays.
Winnebago	W	W	Sand and gravel, peat.
Winneshiek	W	935	Stone, sand and gravel.
Woodbury	W	163	Sand and gravel, clays.
Worth	824	1,640	Stone, sand and gravel, peat.
Wright	W	W	Sand and gravel.
Undistributed[2]	40,347	43,162	
Total[3]	127,821	134,496	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Ringgold County is not listed because no production was reported.

[2] Includes gem stones, some sand and gravel, and stone that cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Iowa business activity

	1971	1972[p]	Change, percent
Employment and labor force, annual average:			
Total labor force thousands	1,263.9	1,296.2	+2.6
Unemployment do	51.0	45.8	−10.2
Employment:			
Manufacturing do	209.2	223.3	+6.7
Construction do	39 8	42.4	+6.5
Mining do	3.0	3.0	--
Transportation and public utilities do	51.8	53.2	+2.7
Finance, insurance, and real estate do	41.8	44.1	+5.5
Wholesale and retail trade do	212.9	225.0	+5.7
Services do	152 6	161.2	+5.6
Government do	177.9	179.2	+.7
Personal income:			
Total millions	$11,088	$12,447	+12.3
Per capita	$3,877	$4,318	+11.4
Construction activity:			
Value of nonresidential construction millions	$135.6	$145.9	+7.6
New housing units authorized	13,683	13,299	−2.4
State highway commission contracts awarded millions	$155.4	[e] $157.6	+1.4
Portland cement shipments to and within Iowa thousand short tons	1,615	1,601	−.9
Mineral production value millions	$127.8	$134.5	+5.2

[e] Estimated. [p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

at Cordova, Ill., about 20 miles up stream from Davenport. The Iowa Air Pollution Control Commission endorsed a proposal to establish an interstate clean-air agency to monitor and control emissions from the Quad-Cities area.

The Iowa Conservation Commission denied a permit to Iowa-Illinois Gas & Electric Co. and Commonwealth Edison Co. to install hot water diffuser pipes under the Mississippi River for cooling purposes at the nuclear powerplant. Ecologists contended the warm water from the plant might endanger the river's aquatic life. The powerplant will have to install more costly cooling towers. On the other hand, the Iowa Conservation Commission approved plans for discharging heated water from Iowa's first nuclear powerplant into the Cedar River. Discharge from the $168 million Duane Arnold Energy Center at Palo will be 3,400 gallons per minute compared with more than 1 million gallons per minute from the Quad Cities plant into the Mississippi. When the plant starts operation, the water will pass through a cooling tower before it is returned to the river.

Two Iowa utilities were making plans for the State's second nuclear-powered electrical generating plant, with a capacity of 800,000 to 1 million kilowatts, to be in operation about 1980 somewhere in central Iowa. Iowa's first nuclear-powered plant at Palo with a capacity of 550 megawatts was scheduled for operation in December 1973.

Central Iowa Power Cooperative will double the capacity of its generating plant north of Creston to 60,000 kilowatts. The new gas-fired turbines will replace the coal-fired steam units now in operation. New environmental regulations would require installation of electrostatic precipitators by 1975 if the coal-fired units were to continue operating. Iowa Southern Utilities joined the Mid-Continent Area Power Pool which came into being during 1972. The company in a joint venture was constructing the 520,000-kilowatt Neal Three generating unit at Sioux City scheduled for operation early in 1976.

The Iowa Geological Survey was conducting a saline water study under a grant from the Office of Saline Water, U.S. Department of the Interior, to determine the economic feasibility of desalination systems for municipal water supplies in Iowa. The Survey, in cooperation with the U.S. Bureau of Mines, sampled operating coal mines to assess the feasibility of coal cleaning with respect to the degree and cost of reducing the sulfur content. The remote sensing laboratory in the Iowa Geological Survey made the following environmental investigations: (1) Thermal investigations of the Mississippi River to determine the thermal regimen of the river system prior to the operation of large powerplants which will use the water for cooling purposes; (2) thermal monitoring of powerplant discharges in cooperation with the Environmental Protection Agency to detect and map thermal outfalls associated with power generating plants in Iowa; (3) several imagery studies related to vegetation, feed lots, and sewage lagoons.

During the year the Iowa Geological Survey issued the following publications: (1) Proceedings, Seminar in Applied Remote Sensing, Public Information Circular (PIC) No. 3; (2) Hydrogeologic Considerations in Solid Waste Storage in Iowa, PIC No. 4; (3) Proceedings, Eighth Forum on Geology of Industrial Minerals, PIC No. 5; (4) Aerial Flood Mapping in Southwestern Iowa, A Preliminary Report, Preliminary Report (PR) No. 1; and (5) The Mississippi River Overflight to Identify Sources of Warm Effluent, PR (unnumbered).

Aided by a grant from the U.S. Geological Survey, the Iowa Geological Survey will conduct a research project utilizing photographs from the Earth Resources Technology Satellite (ERTS). The project will test the value of high-altitude photographs in mapping Midwest land-forms, materials, and soils to develop a wide range of information on mineral and water resources and land use.

The Office of Coal Research, U.S. Department of the Interior, extended for another 2 years an ongoing contract with Iowa State University of Science and Technology for the investigation of electrofluidic processing of coal. Electrofluidic processing is electric resistance heating of coal particles in a bed which is fluidized by passing steam or other gases through it. Future work will continue the theoretical investigation and seek to develop practical processes for producing useful chemicals such as carbon disulfide.

Employment and Injuries.—Complete data are not available but the employment statistics were estimated to be about the same as those in 1971 which indicated 4,847 men worked 9,642,000 man-hours. There were three fatalities in the minerals industry compared with five fatalities in 1971. All three fatalities were in sand and gravel operations.

Iowa had plants competing in the 1972 National Limestone Institute Safety Competition. The nationwide annual contest conducted by the Bureau of Mines in cooperation with the National Limestone Institute awarded Certificates of Achievement in Safety to contestants who operated during the calendar year 1972 without a disabling work injury. The following limestone producers received Certificates of Achievement in Safety: Class III division working 20,001 to 60,000 man-hours—Le Claire Quarries, Inc., Kuhlman Construction Co., Colesburg quarry; and Raid Quarries Corp., Glasgow plant; Class IV, working 10,001 to 20,000 man-hours—Lee Crawford Quarry Co., Cedar Rapids quarry; F. J. Trenkamp Quarries, Preston quarry; C. D. Hess and Son Rock Materials Co., Melcher quarry; and Roverud Construction Co. with two quarries, Becker plant and Hanson plant; Class V, working 10,000 man-hours or less—River Products Co., Keota Grace Hill and Wilson quarry; Harold Hartman, quarry; and Techaw Limestone Co., Grand Mound quarry.

Martin Marietta Aggregates' Earlham quarry in Madison County received a Green Bar Award from the National Crushed Stone Association 47th Annual Safety Contest for 11 consecutive years without a lost-time injury. Two Martin Marietta Aggregates portable units, Day Stripping and Mercer Stripping received Gold Bar Awards for 7 and 8 consecutive years respectively without a lost-time accident.

Van Dusseldorp Sand and Gravel, Inc., Reasonor plant in Jasper County was the winner of the National Sand and Gravel Association's 1972 Safety Contest Class F competition for plants producing less than 60,000 tons. Certificates of Achievement in Safety were awarded to contestants who operated in 1972 without lost-time accidents as follows: Class B (550,000 tons to 1.5 million tons) Martin Marietta Aggregates, West Des Moines plant; Class C (225,000 to 549,999 tons) Martin Marietta Aggregates, Cedar Rapids plant; Class D (170,000 to 224,999 tons) Martin Marietta Aggregates, Waterloo plant and Portable Plant No. 41; Van Dusseldorp Sand and Gravel, Inc., Colfax plant; Class E (60,000 to 169,999 tons) Martin Marietta Aggregates, Eddyville plant; and Class F, C. W. Shirley Co., Waterloo plant and Martin Marietta Aggregates, Portable Plant No. 42.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Portland cement shipments increased 3% in quantity and 4% in value despite early season labor strikes and unusually protracted inclement weather which hampered construction activity. Iowa ranked ninth in the Nation in production and value of portland cement. The average mill value for all types of portland cement was $20.19 per ton in Iowa, less than the $20.37 per ton average for the United States, and 15 cents per ton higher than the 1971 average for the State.

During the year five companies operated a total of 19 kilns at three wet-process and two dry-process plants with a combined annual clinker production capacity of 2,689,000 tons. Martin Marietta Cement planned a major improvement project to modernize its plant at Buffalo near Davenport in Scott County. The Town of Buffalo issued $8.5 million in industrial development revenue bonds to finance dust control facilities, an integral part of the project. Martin Marietta will assume repayment responsibility for the tax-free issue under a lease arrangement with the town. Penn-Dixie Cement Corp. installed a new chain system in kilns at its plant near Des Moines, Polk County. Also, new dust recycling equipment went onstream during the year. At its plant near Mason City, Cerro Gordo County, Northwestern States Portland Cement Co. initiated a quarry modernization program that includes a new primary crusher, new transportation equipment, and expansion of rock storage facilities. The company authorized engineering to increase the annual capacity of the plant by 282,000 tons, and purchased 160 acres of "blue clay" land. A price increase of $2.60 per ton effective January 1, 1972, was not adequate to offset cost increases of 10.5% on coal, 7.8% on natural gas, 5.9% on power, 5.5% on labor, 6.2% on gypsum, and 5.7% on transportation. Lehigh Portland Cement Co. was installing additional dust control equipment at its Mason City plant with completion scheduled for December 1973. Marquette Cement Manufacturing Co. operated a cement plant near West Des Moines.

About 96% of the portland cement shipped was Type I (general construction use) and Type II (moderately low heat and moderate degree of resistance to sulfate attack); the remainder was Type III (high-early-strength) and expansive cement.

Disposition of portland cement shipped by Iowa manufacturers was as follows: 65% went to ready-mix concrete producers; 16% to concrete manufacturers for concrete block, concrete pipes, precast prestressed concrete, and other concrete products; 15% to highway contractors; 3% to building materials dealers; and the remainder to other contractors, government agencies, and for miscellaneous uses. Apparent consumption of portland cement in Iowa during 1972 was 1,608,832 tons, about the same as in the preceding year. More than 900,000 tons of cement produced in Iowa was shipped to customers in nearby States. Nevertheless, despite the abundance of Iowa's cement production, some Iowa customers received cement produced in other States.

Shipments of portland cement were 95% in bulk and the remainder in bags. About 85% of the cement was transported by truck to the customer and the remainder by rail. However, railroads hauled most of the cement from plants to distribution terminals and a small quantity was transported by barge. The Chicago and North Western Railroad inaugurated a "commoditrain" service to determine the economic and operating efficiency for the railroad and the customers for movement of cement during the construction season. The single-commodity trains were making five round trips a week from two cement producers in Mason City to distribution terminals in Burnsville, Minn., carrying more than 45,000 tons of cement.

Although masonry cement shipments were the same in quantity as in the preceding year, the value increased 11%. The average mill value of masonry cement increased $2.98 per ton to $29.03. This was $2.48 per ton higher than the average value for the United States. Penn-Dixie and Lehigh did not produce masonry cement. Consumption of masonry cement in Iowa was 24,714 tons. More than 63% of the masonry cement produced in Iowa was shipped to customers outside of the State.

Clays.—Although production of common clay and shale increased slightly in quantity, the value rose 55%. Thirteen companies operated 18 open cut clay and shale mines in 15 counties. Five companies produced 81% of the clay and shale from nine pits. Can-Tex Industries, Brick and Tile Division of Harsco Corp., and Northwestern States Portland Cement Co. were the two largest producers in the State. The largest production came from Cerro Gordo County, followed by Dallas, Appanoose, and Scott Counties, each with production exceeding 100,000 tons.

About 45% of the total clay and shale production was used in manufacturing portland cement; 23% for making building bricks; 11% for drain tile; and the remainder for lightweight aggregates, sewer pipe, and structural tile.

Competition from plastic drain tubing forced some companies to curtail drain tile production.

Gem Stones.—Small quantities of gem stones and mineral specimens were collected by rockhounds and amateur collectors.

Gypsum.—Iowa ranked fourth in the Nation for the quantity of crude gypsum produced, and second for value of the production. Shipments of crude gypsum increased 20% in quantity and 28% in value in 1972. Gypsum was mined by United States Gypsum Co. at an underground mine near Sperry in Des Moines County, and at four open cut mines near Fort Dodge in Webster County by United States Gypsum Co., National Gypsum Co., Georgia-Pacific Corp. and Celotex Corp., Division of Jim Walter Corp. Each company calcined gypsum at plants adjacent to the mine. Output from United States Gypsum Co.'s open pit mine at Fort Dodge was the sixth largest in the United States and the output of the calcining plant was fourth largest.

On May 16 Iowa noted the 100th anniversary of the gypsum industry in the Fort Dodge area. Iowa has large reserves of gypsum and a potential for further expansion of this industry. Celotex Corp. was planning an expansion of its wallboard plant in Fort Dodge for 1973.

Calcined gypsum production increased 15% in quantity and 12% in value. At the five calcining plants a combined total of 22 kettles, four hydrocal digestors, and six board machines were in operation. The major use for calcined gypsum was in manufacturing wallboard, lath, and sheathing for the building industry, including Type X wallboard, a special fire retardant. Smaller quantities were used for building plasters such as base-coat plaster, mill-mixed basecoat, veneer plaster, gaging and molding plasters, and prepared finishes. Calcined gypsum was also sold for indusrial uses in manufacturing plate glass, terra cotta items, dental and orthopedic plasters, industrial molding, art and casting plasters, and other nonbuilding uses. Uncalcined gypsum was sold for portland cement retarder, filler material, and agricultural use.

Lime.—Although the output of quicklime and hydrated lime declined 20% in quantity the value increased 11% above the 1971 value. The Linwood Stone Products Co., subsidiary of McCarthy Improvement Co., operated an underground limestone mine near Buffalo in Scott County. The company was the State's sole producer of quicklime and hydrated lime for commercial sale. American Crystal Sugar Co. made quicklime for use at its sugar refinery at a lime plant near Mason City in Cerro Gordo County.

About 34% of the lime was used for water purification; 32% for flux in steel manufacturing; 11% for soil stabilization; 9% for sewage treatment and neutralization of waste acids; and 14% for sugar refining, munitions, and miscellaneous uses.

Customers in the State consumed 33% of Iowa's lime. About 40% of the lime was shipped to Illinois, 15% to Wisconsin, and 12% to Minnesota, Nebraska, and Michigan. Total lime consumption in Iowa was 80,800 tons.

Perlite.—Crude perlite, mined in New Mexico was expanded in facilities at four gypsum plants near Fort Dodge in Webster County. Expanded perlite production increased 42% in quantity and 103% in value. The principal use was aggregate in the manufacture of building plaster.

Sand and Gravel.—Production of sand and gravel declined 6% in quantity and 2% in value. Sand and gravel was produced in 81 counties by 121 commercial operators at 240 locations, and by 34 governmental agencies at 38 locations. Sand and gravel producers reported operating 109 stationary plants, 132 portable units, and 26 dredges. Most of the sand and gravel was processed in washing or screening plants. Of the total production 52% was gravel.

Production ranged from 1,000 tons in Davis County to 1,577,000 tons in Polk County. Only one commercial operation produced between 700,000 to 800,000 tons; four between 300,000 to 600,000 tons each; 51 between 100,000 to 300,000 tons each; 103 between 25,000 to 100,000 tons each; and 91 less than 25,000 tons. Nearly 40% of the sand and gravel was produced by operators with less than 100,000 tons annual production. Forty-six individual operations produced 55% of the total output. Maudlin Construction Co., Martin Marietta Corp., and Hallet Construction Co. were the three largest producers, accounting for 35% of the output.

Trucks hauled 97% of the sand and gravel; the remainder was transported by rail.

L. G. Everist, Inc., worked out an economical arrangement for shipping sand and gravel from Howarden to the Sioux City market area with the Milwaukee Road (formerly the Chicago, Milwaukee, St. Paul and Pacific Railroad Co.). Everist furnished all railroad cars required (83-ton capacity); guaranteed shipments of 90,000 tons per year; installed necessary railroad scales and tracks for a single set out and pick up at the plant; and provided all switching service so that the cars were weighed and blocked in proper sequence for the single pick up. Milwaukee Road reduced the freight rate 35% and provided daily service five days a week. During the full shipping season of 1972 the company demonstrated that railroads can move construction aggregates on a dependable schedule cheaper than by trucks. By shifting the weighing, blocking, and load correction to the shipper, the expensive train crew time was reduced, making the whole movement profitable.

About 54% of Iowa's sand and gravel was used for paving roads, 24% was used by the building industry; 8% for fill; and the remainder for railroad ballast and miscellaneous consruction uses. A small quantity of sand was used for ground and unground industrial uses such as molding, sand blasting, and filtration.

Stone.—Output of stone, comprising mostly crushed limestone and dolomite, increased 8% in quantity and value. The average price for crushed and broken stone was $1.77 a ton, unchanged from the preceding year. Stone was quarried by 70 companies and five municipal highway departments at 322 quarries in 66 counties. About

Table 4.—Iowa: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971 Number of mines	1971 Quantity	1971 Value	1972 Number of mines	1972 Quantity	1972 Value
Allamakee	2	W	W	3	5	5
Benton	2	108	149	2	W	W
Black Hawk	8	434	522	7	430	547
Boone	2	W	W	9	427	W
Buena Vista	--	44	33	5	219	120
Calhoun	4	104	54	1	W	W
Carroll	3	250	223	2	W	W
Cerro Gordo	5	508	747	6	445	431
Cherokee	3	W	W	8	583	606
Chickasaw	1	16	16	2	59	91
Clinton	6	145	171	4	147	179
Dallas	6	451	597	5	460	459
Davis	--	--	--	1	1	1
Des Moines	1	198	193	2	307	259
Dickinson	4	347	276	2	W	177
Emmet	6	144	147	2	W	W
Fayette	5	102	127	8	120	164
Franklin	2	W	W	6	268	243
Grundy	--	W	W	1	13	15
Guthrie	3	118	113	2	W	W
Hamilton	1	2	3	4	34	20
Hancock	6	363	317	10	W	W
Hardin	8	218	300	10	318	332
Henry	1	78	89	2	91	111
Howard	3	19	13	2	W	34
Humboldt	2	91	60	4	69	64
Ida	1	13	W	--	--	--
Jefferson	--	9	16	--	--	--
Johnson	1	356	502	2	273	W
Jones	3	30	39	4	50	60
Kossuth	2	156	129	5	367	263
Lee	1	124	101	2	282	199
Linn	4	W	W	4	498	695
Lyon	9	180	156	5	122	82
Marion	2	W	W	5	119	159
Marshall	2	W	W	4	332	W
Mills	2	90	110	1	W	32
Mitchell	2	33	37	2	W	W
Monona	3	285	413	2	133	245
Monroe	--	--	--	1	7	11
Montgomery	--	18	48	1	W	W
Muscatine	8	489	558	6	508	651
O'Brien	1	W	W	3	64	W
Osceola	3	W	241	2	W	W
Palo Alto	4	407	431	2	W	W
Plymouth	4	452	499	3	420	423
Polk	7	1,914	2,711	9	1,577	2,282
Sac	2	328	435	7	576	744
Sioux	7	694	762	7	749	974
Story	3	W	W	9	954	1,203
Union	--	--	--	1	32	120
Webster	8	253	205	10	176	W
Winnebago	2	234	199	3	W	W
Winneshiek	1	65	81	2	W	W
Worth	5	159	99	5	212	W
Wright	4	W	W	3	178	W
Undistributed[1]	[r] 115	8,250	8,609	58	5,483	8,136
Total	290	18,279	20,530	278	17,118	[2] 20,140

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[r] Revised. W Withheld to avoid disclosing individual company confidential data; included in "Undistributed."

[1] Includes Audubon, Bremer, Buchanan, Butler, Cedar (1972), Clay, Clayton, Crawford, Delaware, Dubuque, Floyd, Fremont, Greene, Harrison, Iowa, Jackson, Jasper, Mahaska, Page, Pocahontas, (1971), Potawattamie, Scott (1971), Shelby, Tama, Van Buren, Wapello, Warren, and Woodbury Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data does not add to total shown because of independent rounding.

Table 5.—Iowa: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Commercial operations:				
Sand:				
Building	3,021	3,652	3,023	3,704
Fill	W	W	1,231	967
Paving	2,929	3,674	2,787	3,675
Other uses [1]	1,970	2,291	1,001	1,585
Total [2]	7,920	9,616	8,043	9,930
Gravel:				
Building	1,384	2,463	1,164	2,148
Fill	--	--	187	186
Paving	6,557	5,996	5,111	5,418
Miscellaneous	--	--	107	167
Other uses [3]	1,092	1,140	1,161	1,214
Total [2]	9,034	9,601	7,729	9,133
Government-and-contractor operations:				
Sand:				
Building	--	--	(4)	(4)
Paving	327	430	225	262
Other uses	48	54	3	3
Total [2]	375	484	228	266
Gravel:				
Building	1	2	--	--
Fill	8	1	--	--
Paving	798	733	1,103	809
Other uses	143	93	4	1
Total [2]	950	829	1,107	811
Total sand and gravel	18,279	20,530	17,107	20,140

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."

[1] Includes railroad ballast, blast, filtration (1971), foundry (1972), and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1972) and other uses.

[4] Less than ½ unit.

1.2 million tons were quarried from three underground mines in Van Buren, Scott, and Poweshiek Counties. Twelve companies quarried 58% of the output at 125 locations. Two quarries had an output exceeding 900,000 tons each; seven between 500,000 and 800,000 tons each; 26, between 200,000 and 500,000 tons each; 42, between 100,000 and 200,000 tons each; 126, between 25,000 and 100,000 tons each; and 119, less than 25,000 tons each. Three companies produced dimension limestone at four small quarries in Dubuque, Jackson, and Jones Counties. Crushed stone production exceeded 1 million tons in Madison, Scott, Cerro Gordo, and Linn Counties. Producers operated 37 stationary crushers and 257 portable crushers.

Principal uses for Iowa's stone output were as follows: 60% for road base and paving materials; 14% for manufacturing portland cement; 12% for concrete aggregate; 7% for agricultural uses; and 7% for lime manufacture, riprap and jetty stone, fill, railroad ballast, rough and dressed architectural dimension stone, and miscellaneous chemical and industrial uses. Trucks transported 89% of the stone; railroads 8% and 3% by conveyor to end user. A small quantity was shipped by waterborne transportation.

Although stone was quarried at 327 sites, some stone was crushed in portable plants which did not operate at the same location continuously during the year.

Kaser Construction Co. was developing a new underground limestone mine for concrete aggregates near Harvey in Marion County.

Table 6.—Iowa: Limestone[1] sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972			Type of stone produced in 1972
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Allamakee	5	W	W	12	197	289	Crushed and broken.
Benton	1	10	16	1	16	25	Do.
Buchanan	10	275	424	12	285	419	Do.
Cerro Gordo	6	W	W	6	2,065	2,651	Do.
Clayton	17	[r] 111	[r] 163	22	W	W	Do.
Des Moines	5	718	W	5	785	W	Do.
Dubuque	7	[2] 463	[2] 665	12	705	1,182	Dimension and crushed and broken.
Fayette	21	589	788	15	587	799	Crushed and broken.
Floyd	5	W	W	6	212	278	Do.
Franklin	5	32	51	5	62	98	Do.
Fremont	4	W	W	2	268	W	Do.
Henry	1	60	50	2	W	W	Do.
Howard	6	W	W	10	151	215	Do.
Humboldt	5	937	1,307	5	W	1,217	Do.
Jackson	6	197	261	7	W	313	Dimension and crushed and broken.
Jasper	1	86	W	1	131	W	Crushed and broken.
Jefferson	2	83	150	2	149	278	Do.
Keokuk	3	W	W	3	369	W	Do.
Lee	3	253	442	3	259	427	Do.
Linn	33	2,004	3,570	32	1,843	2,758	Do.
Madison	9	2,223	4,312	9	2,223	4,292	Do.
Mills	2	205	W	2	117	W	Do.
Mitchell	7	398	623	7	352	553	Do.
Montgomery	2	451	W	2	289	W	Do.
Scott	3	1,896	2,558	7	2,140	3,332	Do.
Winneshiek	10	W	W	14	507	W	Do.
Worth	3	302	W	3	W	W	Do.
Undistributed[3]	105	14,096	[r] 29,595	113	13,769	29,530	
Total[4]	287	[2] 25,389	[2] 44,977	320	27,432	48,600	

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[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] "Limestone" used generally to include dolomite.

[2] To avoid disclosing individual company confidential data certain totals are incomplete, dimension stone being concealed.

[3] Includes Adair, Adams, Appanoose, Black Hawk, Bremer, Butler, Cass, Cedar, Chickasaw, Clarke, Clinton, Dallas, Davis (1972), Decatur, Delaware, Grundy, Hamilton, Hancock, Hardin, Harrison, Johnson, Jones, Louisa, Mahaska, Marion, Marshall, Muscatine, Page, Pocahontas, Pottawattamie, Poweshiek, Story, Taylor, Union, Van Buren, Wapello, Washington, Wayne (1972), Webster Counties, and production for which no county breakdown is available.

[4] Data may not add to totals shown because of independent rounding.

MINERAL FUELS

Coal (Bituminous).—Production of coal decreased 14% in quantity and 10% in value. The average price of all coal mined in the State increased 20 cents per ton to $4.86. The strip mine coal price rose 36 cents per ton to $4.91 and the price of underground coal decreased 1 cent per ton to $4.80.

Nearly 59% of the coal was produced at nine strip mines operated by eight companies in three counties. The remainder was produced from two underground mines in Lucas and Monroe Counties. Two strip mines reporting production in 1971 did not operate in 1972: Laddsdale Coal Co. in Van Buren County, and Mich Coal Co. (No. 2 strip) in Wapello County.

Overburden thickness at strip mines ranged from 35 to 60 feet. Thickness of strip coal seams ranged from 36 to 72 inches. Underground coal seams varied from 60 to 66 inches in thickness.

All underground coal was mechanically loaded. Strip mining excavating equipment in operation during the year included 11 power shovels, 13 draglines, eight front-end loaders, and two scrapers. Bucket capacities for the 24 power shovels and dragline excavators were four, between 6 and 15 cubic yards, and 20, 5 cubic yards or less. Shovels and draglines were powered as follows: 21 diesel; two diesel electric; and one shovel powered by a gasoline engine.

About 55% of Iowa's coal production was shipped by rail; the remainder by truck. About 44% of the coal was shipped by unit train. Electric utilities received 93% of Iowa's coal shipments; the remainder was sold to customers in the State for other uses.

Table 7.—Iowa: Limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousands dollars unless otherwise specified)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension:				
Rough Stone:				
Irregular shaped stone	(1)	12	1	14
Rubble	W	W	1	21
Flagging	1	12	W	W
Dressed stone:				
Cut stone ____thousand cubic feet__	--	--	2	13
Sawed stone ____do__	8	35	W	W
House stone veneer ____do__	W	W	18	58
Construction	5	101	4	92
Flagging	(1)	1	(1)	2
Other uses [2]	--	--	2	54
Total __(approximate thousand short tons)__	W	W	10	254
Crushed and broken:				
Bituminous aggregate	1,877	3,330	1,908	3,558
Concrete aggregate	3,156	6,947	3,232	6,953
Dense graded road base stone	5,044	8,710	6,408	11,029
Macadam aggregate	60	102	W	W
Surface treatment aggregate	6,834	11,670	7,167	12,494
Unspecified construction aggregate and roadstone	1,324	2,215	1,111	1,778
Agricultural purposes [3]	1,762	3,439	1,876	4,649
Cement manufacture	3,684	4,974	3,799	4,715
Riprap and jetty stone	254	492	157	265
Other [4]	1,392	3,095	1,765	2,904
Total [5]	25,389	44,977	27,422	48,346

W Withheld to avoid disclosing individual company confidential data.

[1] Less than ½ unit.

[2] Includes rough block, uses not specified, and any use with symbol W in 1972.

[3] Includes agricultural limestone and poultry grit.

[4] Includes crushed and broken stone for fill, flux stone, lime manufacture, mineral fillers, extenders, and whiting, refractory stone, roofing aggregates, chips, and granules, railroad ballast, terrazzo (1972), stone sand (1971), uses not specified, and figures where symbol W appears in crushed and broken stone.

[5] Data may not add to totals shown because of independent rounding.

Iowa's coal consumption was 7,094,000 tons, of which 12% came from mines in the State; 63% from Illinois; 18% from Wyoming; and the remainder from western Kentucky, Kansas, West Virginia, Colorado, and Montana.

Peat.—Sales of peat decreased 9% in quantity and 7% in value. Eli Colby Co. mined peat moss near Lake Mills in Winnebago County and Colby Pioneer Peat Co. mined reed-sedge near Joice in Worth County. Both companies processed the material in plants in Hanlontown. About 56% of the material was sold in bulk and the remainder was packaged. Approximately 91% of the peat was sold for soil improvement; the remainder was for packing flowers, plants, and shrubs, and as an ingredient for potting soils.

METALS

Aluminum.—Aluminum Company of America (Alcoa) started operation of the world's largest aluminum rolling mill at Davenport in January. The new 220-inch mill can reduce 50,000 pound ingots to finish plate 210 inches wide. Because aluminum becomes tougher at cryogenic temperatures where other metals become brittle, the larger plate was expected to find use in the manufacture of vessels for transportation and storage of liquefied natural gas (LNG). Several million pounds of aluminum have been ordered by Norwegians for fabricating six giant spherical holding tanks which will be installed aboard a large LNG freighter.

Ferroalloys.—Operating electric arc furnaces at Keokuk, Kemco Division of Foote Mineral Co., was the State's sole producer of ferrosilicon and silvery pig iron. The company was completing engineering plans for air pollution control equipment for the two newer furnaces.

Table 8.—Iowa: Bituminous coal production, by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines						Production (thousand short tons)						Value (thousands)	
	Underground		Strip		Total		Underground		Strip		Total			
	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972	1971	1972
Lucas	1	1	--	--	1	1	172	113	--	--	172	113	$932	$542
Mahaska	--	--	5	5	5	5	--	--	290	306	290	306	1,282	1,450
Marion	--	--	3	3	3	3	--	--	191	173	191	173	917	908
Monroe	1	1	1	1	2	2	246	239	36	19	282	258	W	1,289
Van Buren	--	--	1	--	1	--	--	--	18	--	18	--	W	--
Wapello	--	--	1	--	1	--	--	--	36	--	36	--	160	--
Undistributed[1]	--	--	--	--	--	--	--	--	--	--	--	--	1,318	--
Total[2]	2	2	11	9	13	11	418	352	571	498	989	851	4,609	4,188

W Withheld to avoid disclosing individual company data; included with "Undistributed."

[1] Includes values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 9.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Martin Marietta Cement ----	Box 4288 606A Davenport Bank Bldg. Davenport, Iowa 52808	Portland and masonry, wet process.	Scott.
Lehigh Portland Cement Co --	Young Bldg., 718 Hamilton St. Allentown, Pa. 18105	Portland and masonry, dry process.	Cerro Gordo.
Marquette Cement Mfg. Co --	20 N. Wacker Dr. Chicago, Ill. 60606	Portland and masonry, wet process.	Polk.
Northwestern States Portland Cement Co.	Box 1008, 12 Second St., N.E. Mason City, Iowa 50401	Portland and masonry, dry process.	Cerro Gordo.
Penn-Dixie Cement Corp ----	Box 152 Nazareth, Pa. 18064	Portland, wet process.	Polk.
Clays and shale:			
Ballou Brick Co ----------	Sergeant Bluff, Iowa 51054 --	Pit and plant --	Woodbury.
Can-Tex Industries, Brick and Tile Division, Harsco Corp.	Box 556, Ottumwa, Iowa 52501	6 pits and plants	Cerro Gordo, Dallas, Keokuk, Mahaska, Polk, Wapello.
Carter-Waters Corp -------	2440 Pennway Kansas City, Mo. 64100	----do----------	Appanoose.
Dewey Portland Cement Co. Div. Martin Marietta Corp.	Box 4288, 802 Kahl Bldg. Davenport, Iowa 52808	Pit ------------	Scott.
Kalo Brick & Tile Co ----	1230 E. First Ave. South Fort Dodge, Iowa 50501	Pit and plant --	Webster.
Lehigh Portland Cement Co	Young Bldg., 718 Hamilton St. Allentown, Pa. 18105	Pit ------------	Cerro Gordo.
Marquette Cement Mfg. Co-	20 N. Wacker Dr. Chicago, Ill. 60606	Pit ------------	Madison.
Northwestern States Portland Cement Co.	Box 1008, 12 Second St., N.E. Mason City, Iowa 50401	Pit ------------	Cerro Gordo.
Rockword Brick & Tile Co -	Rockford, Iowa 50468 --------	Pit and plant --	Floyd.
Sheffield Brick & Tile Co --	Sheffield, Iowa 50475 --------	----do----------	Franklin.
United Brick & Tile Co. of Iowa.	209 Benson Bldg. Sioux City, Iowa 51102	----do----------	Dallas.
Coal (bituminous):			
Beard Coal Co -----------	Route 2, Knoxville, Iowa 51038	Strip mine ----	Marion.
Big Ben Coal Co ---------	Route 3, Chariton, Iowa 50049	Underground mine.	Lucas.
Jude Coal Co -------------	Box 265, Bussey, Iowa 50044 --	Strip mine ----	Mahaska.
Lovilia Coal Co ----------	Route 2, Melrose, Iowa 52569 -	Underground mine.	Monroe.
Mich Coal Co -------------	Box 16, Oskaloosa, Iowa 52577	Two strip mines	Mahaska and Marion.
Weldon Coal Co ----------	Harvey, Iowa 50119 ----------	----do----------	Marion.
Ferroalloys: Foote Mineral Co	320 Concert St. Keokuk, Iowa 52632	Electric furnace	Lee.
Gypsum:			
The Celotex Corp ---------	1500 N. Dale Mabry Tampa, Fla. 33607	Open pit mine, and calcining and board plants.	Webster.
Georgia-Pacific Corp., Gypsum Division.	P. O. Box 311 Portland, Oreg. 97204	----do----------	Do.
National Gypsum Co ------	325 Delaware Ave. Buffalo, N.Y. 14202	----do----------	Do.
United States Gypsum Co --	101 S. Wacker Dr. Chicago, Ill. 60606	----do---------- Underground mine, and calcining and board plant.	Do. Des Moines.
Lime:			
American Crystal Sugar Co	Boston Bldg. Denver, Colo. 80201	Quicklime, shaft kiln.	Cerro Gordo.
Linwood Stone Products Co	Route 2 Davenport, Iowa 52804	Quicklime and hydrated lime, three rotary kilns.	Scott.
Peat:			
Eli Colby Co -------------	Box 248 Lake Mills, Iowa 50450	Bog ----------- Processing plant	Winnebago. Worth.
Colby Pioneer Peat Co ----	Box 8, Hanlontown, Iowa 50444	Bog, processing plant.	Do.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Expanded perlite:			
Celotex Corp	1500 N. Dale Mabry Tampa, Fla. 33607	Processing plant.	Webster.
Georgia-Pacific Corp., Gypsum Division.	P. O. Box 311 Portland, Oreg. 97204	do	Do.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Do.
United States Gypsum Co	101 S. Wacker Dr. Chicago, Ill. 60606	do	Do.
Sand and gravel:			
Concrete Materials Div., Martin Marietta Corp.	4096 First Ave., N.E. Cedar Rapids, Iowa 52401	Pits, underground mines; portable and stationary plants.	Black Hawk, Clayton, Linn, Mahaska, Marshall, Polk, Wapello, Worth, Various.
L. G. Everist, Inc	302 Paulton Bldg. Sioux Falls, South Dakota 57102	Pit; stationary plant.	Sioux.
G. A. Finley, Inc	Harlan, Iowa 51537	Pits, portable and stationary plants.	Audubon, Crawford, Dallas, Pottawattamie, Sac, Shelby.
Hallett Construction Co	Box 13, Boone, Iowa 50036	do	Boone, Cherokee, Decatur, Franklin, Fremont, Iowa, Marshall, Osceola, Page, Polk, Sac, Story, Winnebago.
LaHarv Construction Co	Box 173 Forest City, Iowa 50436	do	Hancock and Winnebago.
Maudlin Construction Co	Box 134 Webster City, Iowa 50595	do	Various.
Peters Construction Co	5225 E. University Des Moines, Iowa 50317	do	Monona and Polk.
Raid Quarries Corp	Farmers & Merchants Bank Bldg. Box 1085, Burlington, Iowa 52601	do	Des Moines, Henry, Lee.
Sankey Sand and Gravel Inc	Britt, Iowa 50423	Pit; portable plants.	Hancock.
Welp & McCarten, Inc	522 S. 22d St. Fort Dodge, Iowa 50501	Pits, portable plants.	Cerro Gordo, Hancock, Howard, Webster.
Stone:			
Limestone and dolomite:			
Alpha Crushed Stone Inc.	Box 267, Marion, Iowa 52302	Quarries, stationary plants.	Clinton.
B. L. Anderson, Inc	327 Guaranty Bldg. Cedar Rapids, Iowa 52400	Quarries; portable plants.	Linn and Jones.
Martin Marietta Aggregates.	Box 189 Cedar Rapids, Iowa 52406	Quarries; portable and stationary plants.	Black Hawk, Bremer, Johnson, Hancock, Linn, Madison, Marshall, Tama, Worth, Various.
Gendler Stone Products Co.	1075 Polk Blvd. Des Moines, Iowa 50311	Quarries; portable plants.	Dallas, Madison, Page, Taylor.
Kaser Construction Co	3111 Ingersol Des Moines, Iowa 50312	do	Des Moines, Fremont, Jasper, Keokuk, Mahaska, Marion, Mills, Montgomery, Poweshiek, Washington.
Northwestern States Portland Cement Co.	Box 1008, 12 Second St., N.E. Mason City, Iowa 50401	Quarry; stationary plant.	Cerro Gordo.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Limestone and dolomite—Continued			
Penn-Dixie Cement Corp.	Box 152, Nazareth, Pa. 18064	Quarry; stationary plant.	Madison.
Raid Quarries Corp	217 Farmers & Merchants Bank Bldg., Box 1085 Burlington, Iowa 52601	Quarries; portable and stationary plants.	Des Moines, Jefferson, Lee, Van Buren.
The River Products Co.	220 Savings & Loan Bldg. Iowa City, Iowa 52240	Quarries, underground mines; portable and stationary plants.	Johnson, Louisa, Washington.
E. I. Sargent Quarries, Inc.	2525 W. Euclid St. Des Moines, Iowa 50310	Quarries; portable plants.	Clarke, Decatur, Madison.
Schildberg Construction Co., Inc.	Box 358 Greenfield, Iowa 50849	do	Adair, Adams, Cass, Madison, Union, Pottawattamie.
Welp & McCarten, Inc.	522 S. 22d St. Fort Dodge, Iowa 50501	Quarries; portable and stationary plants.	Black Hawk, Howard, Humboldt, Webster, Worth.

The Mineral Industry of Kansas

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of Kansas for collecting information on all minerals except fuels.

By Bernadette Michalski [1] and Lawrence L. Brady [2]

Kansas mineral production by value totaled $584.5 million in 1972, a decline of less than 1% from the $589.4 million in 1971. This decline in total mineral production value is the first experienced since 1968. Both declines were largely attributable to a reduction in petroleum production, a commodity that constituted 52% of the total mineral production value in 1967 and 44% in 1972. Other mineral commodities produced in Kansas, listed in order of descending value, include natural gas, natural gas liquids, cement, helium, stone and salt. Mineral fuels and related products contributed about $487 million or 83.3% of total value of mineral production. The remainder was attributable to the nonmetallic minerals industry.

Trends and Developments.—Important trends in Kansas include the strong increase in recent years in cement production and the continued decrease in the amount of petroleum produced. Natural gas appears to have reached its maximum production and now is starting a slow production decline similar to that of petroleum. Other commodities during 1972 showed only small variations in the quantities produced from previous years. However, increases in unit value of products, especially natural gas and natural gas liquids, continue to show strong advances.

Contracts awarded for highway construction by the Kansas Highway Commission totaled $86.6 million for 1972. This was a drop of approximately $15 million from the record contract year of 1971. Several major highway improvements were opened in 1972 including a 23 mile segment of interstate highway between Newton and McPherson; construction of 2.3 miles of viaduct above the Wichita street system; 49 miles of freeways; and 31 miles of new two-lane roads.

In 1972, Kansas abandoned its pay-before-you-build approach to State highway construction and adopted bond financing to build a proposed freeway system. Kansas Highway Commission officials indicated that this change resulted from a legislature decision in 1970 that designated nine freeway corridors totaling 1,234 miles, and allocated a portion of highway funds exclusively for freeway construction. Financing was changed and now 20% of net gasoline tax revenues is being used to support interest and principal payments for land. Under terms of the law, the Highway Commission has sold two $40 million issues of highway bonds of the $320 million authorized over an 8 year period.

A limestone scrubber system for the new 430,000 kilowatt powerplant in Lawrence continued to undergo tests during 1972. The system utilizes finely ground limestone that is injected into the boiler along with the coal. One major change in the design involves the raising of the point of limestone injection into the boiler above that of the coal injection level. In the original design the coal and limestone were injected into the boiler at the same level. This resulted in extensive caking of the lime product on the boiler walls.

Assembly of the $34 million limestone scrubber unit at the new coal-fired La Cygne powerplant continued in 1972. Testing of this large unit will be initiated in

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Table 1.—Mineral production in Kansas[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland thousand short tons	1,731	$29,961	1,839	$35,432
Masonry do	50	1,232	59	1,452
Clays do	879	1,151	1,170	1,457
Coal (bituminous) do	1,151	6,579	1,227	7,835
Helium:				
Crude million cubic feet	2,510	30,120	2,273	27,276
High-purity do	[2] 342	7,182	[2] 384	8,064
Lime thousand short tons	8	W	9	172
Natural gas million cubic feet	885,144	127,267	889,268	127,859
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	5,387	12,253	5,506	13,170
LP gases do	23,215	39,001	25,099	43,170
Petroleum (crude) do	78,532	276,433	73,744	259,578
Salt[3] thousand short tons	1,240	18,712	1,369	20,562
Sand and gravel do	11,862	11,351	11,591	10,920
Stone do	[4] 14,908	23,697	[4] 14,547	[4] 23,849
Value of items that cannot be disclosed: Gypsum, pumice, salt (brine), stone (dimension), and values indicated by the symbol W	XX	4,505	XX	3,741
Total	XX	589,444	XX	584,537
Total 1967 constant dollars	XX	416,174	XX	[p] 486,276

[p] Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Helium measured at 14.7 pounds per square inch absolute at 70°F.

[3] Excludes salt in brine; included with "Values of items that cannot be disclosed."

[4] Excludes dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Kansas, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Allen	$7,641	$8,623	Cement, stone, clays, natural gas.
Anderson	143	148	Stone.
Atchison	W	W	Do.
Barber	6,953	6,832	Natural gas, petroleum, gypsum, natural gas liquids, sand and gravel.
Barton	18,887	14,100	Petroleum, salt, sand and gravel, clays, natural gas.
Bourbon	W	W	Stone.
Butler	12,885	W	Petroleum, stone.
Chase	126	114	Stone, petroleum, sand and gravel.
Chautauqua	W	W	Stone, natural gas.
Cherokee	4,323	W	Coal, clays, stone.
Cheyenne	W	W	Sand and gravel.
Clark	965	833	Natural gas, petroleum, sand and gravel.
Clay	W	W	Stone, sand and gravel.
Cloud	W	W	Clays, sand and gravel, stone.
Coffey	W	W	Stone.
Comanche	1,407	514	Natural gas, petroleum, sand and gravel.
Cowley	7,237	7,316	Petroleum, sand and gravel, stone, natural gas.
Crawford	2,629	W	Coal, clays.
Decatur	2,248	W	Petroleum, sand and gravel.
Dickinson	687	W	Stone, sand and gravel, petroleum.
Doniphan	657	749	Stone.
Douglas	W	W	Sand and gravel.
Edwards	2,594	W	Petroleum, natural gas, sand and gravel.
Elk	W	1,019	Stone, natural gas, sand and gravel.
Ellis	23,944	22,207	Petroleum, sand and gravel, stone.
Ellsworth	25,365	26,126	Natural gas liquids, petroleum, salt, natural gas, clays, sand and gravel.
Finney	5,401	W	Petroleum, natural gas liquids, sand and gravel.
Ford	431	500	Natural gas liquids, sand and gravel, petroleum, natural gas.
Franklin	W	W	Stone, clays.
Geary	W	W	Stone, sand and gravel.
Gove	1,182	1,414	Petroleum, sand and gravel.
Graham	13,239	12,388	Do.
Grant	15,057	14,140	Natural gas liquids, petroleum, sand and gravel.
Gray	W	W	Sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Kansas, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Greeley	--	W	Sand and gravel.
Greenwood	W	W	Petroleum, stone.
Hamilton	$1,235	$984	Natural gas, petroleum, sand and gravel.
Harper	4,088	2,366	Natural gas liquids, petroleum, natural gas, sand and gravel.
Harvey	W	W	Petroleum, natural gas liquids.
Haskell	13,170	14,894	Helium, petroleum, natural gas, sand and gravel.
Hodgeman	4,123	W	Petroleum, sand and gravel.
Jackson	80	71	Stone, sand and gravel.
Jefferson	W	W	Stone.
Jewell	W	W	Stone, sand and gravel.
Johnson	W	4,017	Do.
Kearny	714	634	Petroleum, natural gas liquids, sand and gravel, natural gas.
Kingman	10,896	11,371	Petroleum, natural gas liquids, natural gas, sand and gravel.
Kiowa	3,159	3,912	Petroleum, natural gas, sand and gravel.
Labette	406	523	Stone.
Lane	215	W	Petroleum, sand and gravel.
Leavenworth	W	W	Stone, sand and gravel.
Lincoln	W	W	Stone.
Linn	293	W	Do.
Logan	241	W	Petroleum, sand and gravel.
Lyon	927	823	Petroleum.
McPherson	5,846	6,278	Petroleum, natural gas, clays, stone, pumice, sand and gravel.
Marion	2,114	2,126	Petroleum, stone, natural gas.
Marshall	W	1,325	Gypsum, sand and gravel, stone.
Meade	4,213	3,925	Natural gas, petroleum, sand and gravel.
Miami	81	W	Stone.
Mitchell	1	W	Sand and gravel.
Montgomery	6,445	6,567	Cement, stone, clays.
Morris	1,098	1,084	Petroleum, stone, sand and gravel.
Morton	20,098	21,018	Petroleum, natural gas, helium, natural gas liquids.
Nemaha	W	131	Sand and gravel, stone.
Neosho	10,369	W	Cement, stone, sand and gravel, clays.
Ness	9,451	10,423	Petroleum, sand and gravel.
Norton	1,464	W	Petroleum, sand and gravel, pumice.
Osage	30	--	
Osborne	148	141	Petroleum, sand and gravel.
Ottawa	W	1	Sand and gravel.
Pawnee	4,010	3,417	Petroleum, natural gas, sand and gravel.
Phillips	7,022	6,600	Petroleum, sand and gravel.
Pottawatomie	W	W	Stone, petroleum, sand and gravel.
Pratt	3,918	3,175	Petroleum, natural gas, sand and gravel.
Rawlins	W	2,083	Petroleum, sand and gravel.
Reno	16,563	17,946	Salt, petroleum, sand and gravel, natural gas.
Republic	W	86	Sand and gravel.
Rice	25,934	24,779	Petroleum, salt, helium, stone, natural gas, sand and gravel.
Riley	998	W	Stone, petroleum, sand and gravel.
Rooks	W	W	Petroleum, sand and gravel.
Rush	6,486	6,446	Petroleum, helium, natural gas, stone, sand and gravel.
Russell	21,649	21,040	Petroleum, sand and gravel, natural gas.
Saline	W	W	Petroleum, sand and gravel.
Scott	3,588	3,854	Helium, natural gas liquids, petroleum, sand and gravel, natural gas.
Sedgwick	10,321	8,256	Petroleum, natural gas liquids, sand and gravel, salt.
Seward	27,394	27,324	Helium, natural gas liquids, petroleum, natural gas, sand and gravel.
Shawnee	W	W	Stone, sand and gravel.
Sheridan	2,186	W	Petroleum, sand and gravel.
Sherman	294	W	Lime, sand and gravel, petroleum, stone.
Smith	W	W	Stone, sand and gravel.
Stafford	11,910	11,122	Petroleum, natural gas, sand and gravel.
Stanton	87	92	Petroleum, natural gas.
Stevens	3,656	2,912	Do.
Sumner	6,404	5,701	Petroleum, natural gas, sand and gravel.
Thomas	106	W	Sand and gravel, petroleum.
Trego	3,781	W	Petroleum, sand and gravel.
Wabaunsee	1,642	1,599	Petroleum.
Wallace	W	--	
Washington	W	W	Sand and gravel, stone.
Wichita	W	W	Sand and gravel.
Wilson	5,553	W	Cement, clays, stone.
Woodson	W	W	Stone.
Wyandotte	10,769	W	Cement, sand and gravel, stone.
Undistributed [2]	160,311	228,468	
Total	[3] 589,444	584,537	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Brown County is not listed because no production was reported.

[2] Includes some stone, sand and gravel, petroleum, natural gas, and natural gas liquids that cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data does not add to total shown because of independent rounding.

Table 3.—Indicators of Kansas business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total civilian labor force . . . thousands	893.7	914.2	+2.3
Unemployment . . . do	51.0	35.4	−30.6
Employment:			
Agricultural . . . do	166.7	167.6	+0.5
Nonagricultural:			
Construction . . . do	31.2	34.0	+9.0
Mining . . . do	10.0	9.7	−3.0
Manufacturing . . . do	129.8	143.0	+10.2
Services . . . do	104.5	108.3	+3.6
Finance, insurance, and real estate . . . do	30.9	32.0	+3.6
Wholesale and retail . . . do	162.1	169.2	+4.4
Transportation and public utilities . . . do	51.2	52.2	+2.0
Government . . . do	156.3	162.8	+4.2
Personal income:			
Total . . . millions	$9,460	$10,371	+9.6
Per capita	$4,192	$4,593	+9.6
Construction activity:			
Building permits, total private nonresidential . . . millions	$177.3	$139.1	−21.6
Cement shipments to and within Kansas . . . thousand short tons	1,003	1,072	+6.9
Farm marketing receipts . . . millions	$2,451.3	$3,066.7	+25.1
Mineral production value . . . do	$589.4	$584.5	−0.8

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

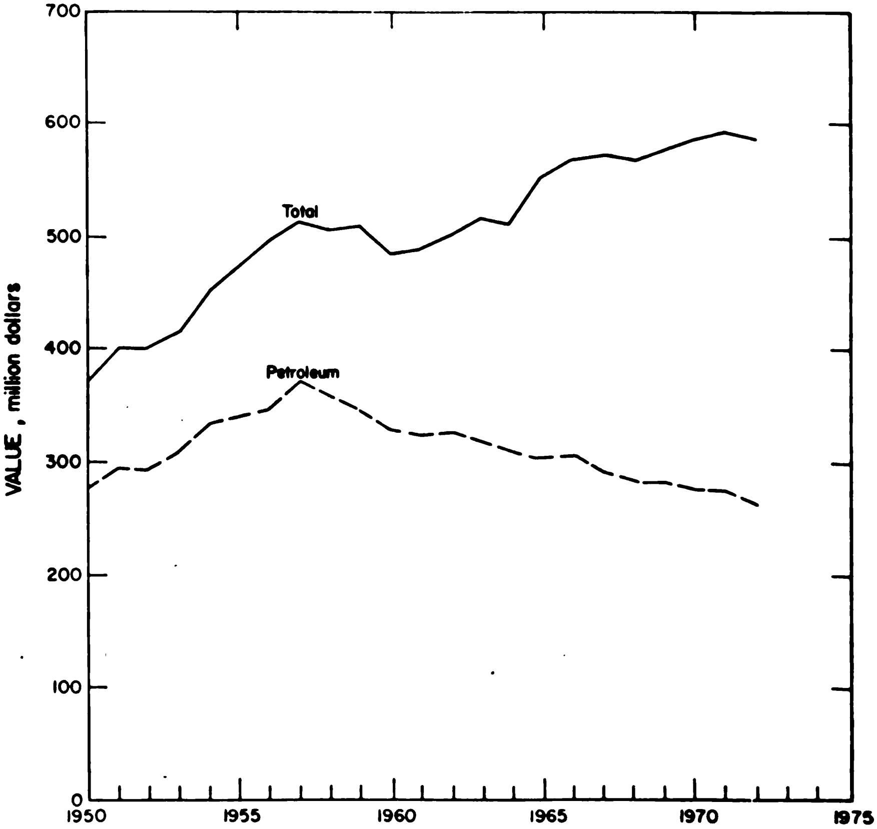

Figure 1.—Value of petroleum, and total value of mineral production in Kansas.

1973. Because of the size of this scrubber and its potential in the future of the coal-fired powerplants, extensive interest is shown in its operational tests.

Employment.—A decrease in the average annual employment in the mining and crude petroleum industries continued into 1972. The Employment Security Division of the Kansas Department of Labor reported employment of 9,700 persons in the mining industry in 1972 as compared with an updated figure of 10,000 persons in 1971. In the crude petroleum area 8,200 were employed in 1972.

Statistics compiled by the Workman's Compensation Commission show a total of 592 injuries occuring in the mining and crude petroleum industries during 1972. One fatality occurred in the crude petroleum industry.

Legislation & Government Programs.—The Kansas Legislature in 1972 passed a law exempting for 5 years increased taxes resulting from the increased value of real estate reclaimed after surface mining activity. This law is limited to properties where surface mining activities were terminated prior to January 1, 1969 and on which reclamation work was completed.

During 1972 the Kansas Geological Survey and the U.S. Geological Survey continued cooperative investigations of surface water and ground water resources in the State. One new cooperative program initiated in 1972 involves a geologic study of the corridor between Kansas City and Topeka for use in future land planning. Mineral resources, water quality and quantity, general soil and geological mapping, and environmental considerations are all included in the study.

The Ozarks Regional Commission funded $34,000 to the Kansas Institute for Mineral Resource Research for a study of new coal mining methods. Included in the Institute are the Kansas Geological Survey and the School of Engineering at the University of Kansas. Objective of the research is to determine the feasibility of new mining methods that will allow mining of shallow-cover coal without extensive damage to the environment. The research involved the combination of ideas from surface and underground mining to limit the extent of disturbance caused by present strip-mining methods.

A demonstration of the feasibility of reclaiming previously mined land into useful agriculture and recreation land was continued in 1972 under funding by the Ozarks Regional Commission. The Kansas Geological Survey served as principal investigator on the project under a $57,000 grant until October 1972. The demonstration work consisted of a cost-share arrangement with land owners for reclamation of plots up to 20 acres in size. To date, over 1,150 acres have been reclaimed under this program in four southeast Kansas counties. In October, the Ozarks Regional Commission provided a grant to Wichita State University to continue the work in Kansas and expand the program into Missouri and Oklahoma.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	228	283	65	472	1	9	21.20	NA
Nonmetal	555	250	139	1,087	--	36	33.11	1,092
Sand and gravel	636	237	127	1,138	1	17	15.89	5,519
Stone	1,787	259	449	3,789	--	33	8.71	288
Total	3,056	255	780	6,481	2	95	14.97	NA
1972:[1]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Nonmetal	450	253	114	894	--	33	33.90	403
Sand and gravel	310	240	74	671	2	15	25.35	18,851
Stone	1,205	249	300	2,467	--	43	17.43	574
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

Cooperative research continued between the Atomic Energy Commission (AEC) and the Kansas Geological Survey on the proposed location of the AEC Radioactive Waste Repository Site in Kansas salt beds. In 1972, three sites were selected for additional study—two in Lincoln County and one in Wichita County. Exploratory data obtained at these sites indicated that all required criteria of AEC necessary for the waste repository site could not be met at any of the sites.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal.—Kansas coal output, reported at 1,227,000 tons in 1972, was obtained from four strip mining operations in the southeastern coalfield covering Cherokee and Crawford Counties. Three companies were engaged in coal extraction in the State; however, the Pittsburgh & Midway Coal Mining Co. led other producers by a wide margin, providing 67% of the total State coal output in 1972.

Of total coal production, 1,139,584 tons was transported by rail, 84,996 tons was transported by truck, and the remaining 2,393 tons by other means.

Equipment used in Kansas strip-mining operations during 1972 included a total of 18 bulldozers, four electric power shovels, three electric draglines, two diesel lines, four horizontal power drills, three vertical power drills, three front-end loaders, and two carryall scrapers in the 16- to 50 cubic-yard-capacity range.

During the year, strip miners worked seams varying in thickness from 14 to 24 inches with overburden ranging from 24 to 52 feet in thickness. These figures represent the highest known overburden-to-coal ratio in the United States.

Virtually all coal produced in Kansas is consumed in production of electric power. The commissioning of the La Cygne powerplant in 1973 will bring an additional demand upon the coal industry. Production will be augmented with the opening of a second Pittsburgh & Midway Coal Co. mine in early 1973. The Midway mine is located on the Kansas-Missouri border. During 1973, the deposit will be mined on both sides of the State line. In succeeding years, however, it will be mined entirely on the Missouri side. At peak production, mine capacity will be 2.4 million tons annually.

Natural Gas.—Proved recoverable reserves of natural gas as of December 31, 1972, according to the American Gas Association, Inc. (AGA), totaled 11.9 trillion cubic feet. Total reserves declined by 4.8% from the proved reserve level reported for 1971.

Natural gas price increases were instrumental in promoting expanded drilling activity in the State. Gas well completions totaled 368, an increase of 256 over the previous year's total. The Panoma gas area, covering Grant, Stanton, Stevens, and Morton Counties, yielded 262 of the new gas wells in 1972. Increased price levels are apparent when comparing the peak production year of 1970, which yielded 900 billion cubic feet of gas valued at $126 million, with the 1972 output of 889 billion cubic feet valued at $128 million.

Natural Gas Liquids.—Natural gas liquids production was reported at 30.6 million barrels in 1971, nearly 2 million barrels over the previous year's production level. Included in the 1972 figure were 25.1 million barrels of liquified petroleum gases and ethane averaging $1.72 per barrel and 5.5 million barrels of natural gasoline and cycle products averaging $2.39 per barrel.

Proved recoverable reserves of natural gas liquids were augmented by 116.5 million barrels in 1972 to a total of 393.1 million barrels, based on data released by the AGA. Reserves are rated on the capability of extraction and not on the natural gas liquids content of natural gas.

Petroleum.—Crude production declined for the sixth consecutive year. Output in 1972 ran 6.1% below the previous year's level. In spite of this decline, petroleum remains the most important mineral commodity in the State, accounting for about half of the total value of Kansas mineral production.

The decline in crude oil production was accompanied by a continued decrease in proved crude oil reserves. The estimated proved crude oil reserves for Kansas, as of December 31, 1972, was 453,394 thousand barrels, a 9.6% or 48,158-thousand-barrel

Table 5.—Kansas: Natural gasoline and LP gases produced in 1972

(42-gallon barrels)

Company	Location		Natural gasoline	Butane	Propane	LP gases	Total
	Nearest town	County					
Alamo Chemical Co.	Elkhart	Morton	556,464	--	--	--	556,464
Amoco Production Co.	Ulysses	Grant	--	--	--	192,304	192,304
	do	do	840,697	834,362	988,359	--	2,663,418
Anadarko Production Co.	Liberal	Seward	117,007	--	104,111	--	221,118
	Elkhart	Morton	89,838	--	62,869	--	152,707
Cities Service Cryogenics, Inc.	Scott City	Scott	241,815	345,450	919,555	138,180	1,645,000
Cities Service Helex, Inc.	Satanta	Grant	184,784	443,481	2,845,670	221,740	3,695,675
Cities Service Oil Co.	Cheney	Kingman	--	--	--	608,827	608,827
	Midway	do	--	--	--	276,966	276,966
	Wichita	Sedgwick	350,098	440,198	374,829	--	1,165,125
	Wilburton	Morton	--	--	--	115,037	115,037
Colorado Interstate Gas Co.	Lakin	Kearny	122,954	--	--	--	122,954
Kansas Refined Helium Plant Co.	Otis	Rush	46,447	--	--	--	46,447
Kathol Natural Gas, Inc.	St. John	Stafford	14,752	17,958	17,015	--	49,725
Mesa Petroleum Co.	Ulysses	Grant	--	--	--	1,523,062	1,523,062
Mobil Oil Corp.	Hickok	do	238,132	--	101,264	364,759	704,155
	Spivey	Harper	240,935	109,449	228,788	--	579,172
National Helium Corp.	Liberal	Seward	973,642	1,034,105	1,580,937	--	3,588,684
Northern Gas Products Co.	Bushton	Ellsworth	906,780	2,010,787	5,816,128	--	[1] 11,766,552
Northern Natural Gas Co.	Holcomb	Finney	234,597	--	--	--	234,597
	Sublette	Seward	465,543	--	--	--	465,543
Peoples Natural Gas Division	Burrton	Harvey	2,772	--	--	--	2,772
	Johnson City	Stanton	--	--	--	7,487	7,487
Skelly Oil Co.	Medicine Lodge	Barber	27,470	22,915	44,100	1,795	96,280
	Minneola	Ford	31,577	31,565	59,629	--	122,771

[1] Includes 3,032,857 barrels of ethane.

Source: Kansas State Corporation Commission.

decline from the previous year's level. The largest percentage of drilling and success during the year was along the west flank of the Central Kansas Uplift and the Anadarko Basin area in southwest Kansas.

Drilling and Exploration.—During 1972, a total of 2,398 oil and gas wells were drilled in Kansas. Of these, 1,634 were production wells and 764 were exploratory wells; 1,248 resulted in oil or gas recovery and 1,150 were dry. Drilling activity resulted in 880 new oil wells, a decrease of 20% from 1,099 completions reported in 1971; however, gas well completions increased by 228% from 112 in 1971 to 368 in 1972.

Total footage attributable to oil and gas drilling activity was 7,905,299 feet, an increase of 718,920 feet from that of the previous year.

Ness and Grant Counties accounted for 14% of total wells drilled in Kansas. These counties, combined with Cowley, Ellis, Barton, Graham, and Ellsworth Counties, represented 29% of all Kansas well completions in 1972. Footage drilled in these counties totaled 2,461,603 feet, averaging 3,497 feet per well. Ness County was foremost in drilling operations with a reported 88 production wells and 83 exploratory wells drilled during the year.

Solvent injection using the Bureau of Mines Solfrac process was undertaken at the heavy-oil recovery test site near Bartlett. The testing period extended from May to September. Total production of crude oil and solvent mix was 457 barrels with an oil content of 7.9%, or 36 barrels.

Because initial-phase testing revealed the necessity of a lengthy and costly cleanout period, a new approach was tried out for well completion. In September two 13½-inch-diameter wells were drilled to 360 feet. Each well was shot with 3,100 pounds of pelletized TNT. A 7⅞-inch-diameter observation well was drilled and cored to check rubblization of the zone. Two 9-inch-diameter wells were drilled to complete the five-spot. Early results of tests to check rubblization and interwell communication resulting from the explosion were satisfactory. This method of completing producing wells makes it possible to maintain an open face on the formation throughout the section. In the earlier test the lower section that had the highest oil saturation was never adequately cleaned out to receive the solvent. A solvent distillation unit of 25-barrel-per-day capacity is being fabricated and soon will be placed in operation, so that the crude oil can be separated and the solvent reused.

Refineries.—Of the 11 refineries located in Kansas, 10 were in operation, with a combined throughput capacity of 378,200 barrels per day. The North American Petroleum Corp. Shallow Water refinery was not operating. Operable shutdown capacity for this refinery is 5,000 barrels per day.

Crude runs to stills totaled 133.3 million barrels in 1972. Of this total, 68.1 million barrels was Kansas crude, most of which was transported to the refineries via pipeline, with the exception of 2.1 million barrels transported by rail or tank car. Another 61 million barrels, virtually all transported by pipeline, was received from other States. About 3.7 million barrels was obtained from Canada via pipeline. The remainder was obtained from refinery stocks. Other refinery imports included 5.5 million barrels of natural gasoline and isopentane, 3 million barrels of isobutane, and 2 million barrels of normal butane. Refinery product output in 1972 totaled 151.1 million barrels.

Consumption of fuels by Kansas refineries is reported as follows: Distillate fuel oil, 1,000 barrels; residual fuel oil, 918,000 barrels; liquefied petroleum gas, 311,000 barrels; natural gas, 33.9 billion cubic feet; refinery gas, 28.9 billion cubic feet; petroleum coke, 282,000 tons; and purchased electricity, 329 million kilowatt-hours.

Table 6.—Kansas: Crude oil production, indicated demand, and stocks in 1972, by month

(Thousand 42-gallon barrels)

Month	Production	Indicated Demand	End-of-month stocks originating within Kansas
January	6,204	6,682	7,288
February	6,159	5,923	7,524
March	6,594	6,507	7,611
April	6,196	5,864	7,943
May	6,513	6,686	7,820
June	6,183	6,184	7,819
July	6,154	6,789	7,184
August	6,272	6,792	6,664
September	5,980	6,114	6,580
October	6,078	6,126	6,482
November	5,702	6,384	5,800
December	5,709	5,905	5,604
Total:			
1972	73,744	75,906	XX
1971	78,532	78,053	XX

XX Not applicable.

Table 7.—Kansas: Crude petroleum production, by field [1]

(Thousand 42-gallon barrels)

Field [2]	1971	1972	Cumulative to Dec. 31, 1972
Bemis-Shutts	2,590	2,260	214,326
Chase-Silica	1,600	1,510	247,972
El Dorado	1,500	1,475	277,648
Hall-Gurney	2,480	2,335	123,352
Kraft-Prusa	3,200	1,065	116,041
Trapp	1,930	1,775	204,225
Other fields [3]	65,232	63,324	NA
Total	78,532	73,744	NA

NA Not available.

[1] Fields with annual production in excess of 1 million barrels.

[2] Breakdown for individual fields from the Oil and Gas Journal.

[3] Bureau of Mines figures.

Table 8.—Kansas: Oil and gas well drilling completions, by county

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Allen	18	1	5	--	--	--	24	19,902
Anderson	19	--	7	--	--	4	30	24,085
Atchison	--	--	--	--	--	5	5	11,720
Barber	3	7	7	2	--	5	24	109,128
Barton	27	--	24	6	--	17	74	247,012
Bourbon	--	--	3	--	--	--	3	2,417
Butler	28	--	17	3	--	13	61	169,076
Chase	--	--	2	--	1	6	9	22,271
Chautauqua	31	--	13	--	--	1	45	66,809
Cherokee	--	--	--	--	--	1	1	210
Clark	--	--	3	--	--	7	10	55,340
Clay	--	--	--	--	--	1	1	3,011
Coffey	13	--	7	3	1	22	46	89,677
Comanche	5	5	3	--	2	6	21	109,107
Cowley	27	3	26	4	1	22	83	232,945
Crawford	1	--	--	--	--	--	1	388
Decatur	12	--	5	1	--	5	23	84,898
Doniphan	--	--	--	--	--	1	1	2,270
Douglas	--	1	--	--	--	--	1	955
Edwards	4	9	5	--	3	5	26	103,645
Elk	25	--	12	--	--	5	42	77,746
Ellis	26	--	30	4	--	18	78	273,852
Ellsworth	34	3	15	1	2	16	71	216,280
Finney	31	--	9	6	--	7	53	253,886
Ford	--	--	2	1	--	10	13	68,854
Franklin	1	--	1	--	--	1	3	2,628
Gove	7	--	11	5	--	24	47	202,400
Graham	14	--	19	6	--	35	74	290,536
Grant	--	150	2	--	--	1	153	441,354
Gray	--	--	--	--	--	2	2	10,274
Greeley	--	--	--	--	1	3	4	16,741
Greenwood	26	--	8	--	--	6	40	86,340
Hamilton	--	2	2	--	--	1	5	10,259
Harper	8	2	6	1	--	14	31	145,364
Harvey	2	--	4	1	1	3	11	37,274
Haskell	--	--	--	1	--	--	1	5,459
Hodgeman	12	--	9	5	--	34	60	272,884
Jackson	--	--	1	--	--	3	4	14,404
Johnson	--	2	1	--	2	1	6	2,715
Kearny	--	6	1	1	--	7	15	52,055
Kingman	4	5	6	1	1	12	29	120,679
Kiowa	6	3	7	--	--	5	21	99,659
Labette	4	--	2	--	--	--	6	2,454
Lane	4	--	2	5	--	10	21	94,252
Leavenworth	--	3	--	--	--	3	6	9,200
Linn	5	1	4	--	--	1	11	7,175
Logan	1	--	--	--	--	1	2	9,397
Lyon	4	--	3	1	--	6	14	36,686
McPherson	11	--	10	--	--	6	27	76,702
Marion	8	--	2	--	--	1	11	26,906
Meade	3	5	8	1	3	9	29	164,697
Miami	6	1	4	--	1	1	13	6,597
Montgomery	22	2	4	--	--	0	28	31,267
Morris	--	--	--	--	--	3	3	9,740

Table 8.—Kansas: Oil and gas well drilling completions, by county—Continued

County	Proved field wells			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Morton	7	17	6	1	--	--	31	118,656
Nemaha	--	--	--	--	--	1	1	3,972
Neosho	18	--	5	--	--	1	24	15,677
Ness	50	--	38	24	--	59	171	759,624
Norton	--	--	--	--	--	5	5	18,607
Osborne	--	--	--	--	--	3	3	9,500
Pawnee	8	5	18	--	2	7	40	162,156
Phillips	11	--	6	2	--	1	20	69,486
Pottawatomie	--	--	--	--	--	11	11	24,942
Pratt	2	--	3	--	--	11	16	69,531
Rawlins	4	--	--	2	--	7	13	55,086
Reno	16	--	4	--	--	3	23	81,461
Rice	32	--	12	--	--	5	49	166,476
Riley	2	--	3	--	--	0	5	8,345
Rooks	20	--	16	5	--	25	66	229,742
Rush	4	4	5	2	--	19	34	129,237
Russell	27	2	16	4	--	9	58	175,158
Saline	3	--	--	--	--	1	4	11,514
Scott	2	--	2	1	--	4	9	41,539
Sedgwick	7	--	5	1	--	6	19	60,007
Seward	6	3	1	3	3	4	20	118,473
Sheridan	3	--	13	3	--	15	34	133,812
Sherman	--	--	--	--	--	1	1	5,568
Smith	--	--	--	--	--	1	1	4,190
Stafford	22	5	17	5	--	6	55	204,268
Stanton	--	55	3	--	--	1	59	167,505
Stevens	--	38	5	--	2	1	46	149,493
Sumner	10	2	9	1	--	16	38	128,119
Thomas	--	--	--	1	--	5	6	25,566
Trego	7	--	8	2	--	17	34	140,741
Wabaunsee	--	--	--	--	--	2	2	6,376
Wallace	--	--	--	--	--	1	1	5,280
Wilson	7	--	1	--	--	1	9	8,691
Woodson	43	--	21	1	--	2	67	70,424
Total	763	342	529	117	26	621	2,398	7,905,299

Source: American Petroleum Institute.

NONMETALS

Total value of nonmetals produced in 1972 was $97.5 million compared with $90.6 million in the previous year. More than a third of the total value of nonmetal output was attributed to the production of portland cement. Other leading commodities by value of output were stone, salt, and sand and gravel. The combined output of the above-mentioned commodities constituted 93% of the value of 1972 nonmetallic mineral production in Kansas.

Cement.—Production of both portland and masonry cement continued to spiral upward as a result of expansion and modernization activities at existing installations. Nearly one-half of the total production, or 1 million tons of portland cement and 24,000 tons of masonry cement, were consumed within the State.

Clays.—Production of clay and shale during 1972 increased by 33% in volume and 27% in value compared with the previous year's level. Of the total output of 1,169,528 tons about a third, or 398,989 tons, was consumed in the manufacture of brick; another third, or 393,659 tons, was consumed in the manufacture of cement; and the final third was consumed in the manufacture of lightweight aggregates, sewer pipes, drain tiles, and pottery.

Gypsum.—Two gypsum mines were in operation in 1972. The National Gypsum Co. has a mine near Sun City, in Barber County, and transports crushed gypsum

Table 9.—Kansas: Portland cement salient statistics

(Short tons)

	1971	1972
Number of active plants	5	5
Production	1,799,235	1,985,970
Shipments from mills:		
Quantity	1,731,101	1,889,080
Value	$29,960,589	$35,432,074
Stocks at mills, Dec. 31	211,360	231,643

Table 10.—Kansas: Masonry cement salient statistics

(Short tons)

	1971	1972
Number of active plants	5	5
Production	43,181	53,731
Shipments from mills:		
Quantity	49,760	58,870
Value	$1,231,743	$1,451,852
Stocks at mills, Dec. 31	27,343	22,303

from the Blaine Formation of the Lower Permian strata. In Marshall County, the Bestwall Div. of the Georgia-Pacific Corp. mines gypsum from the Easly Creek Shale (Lower Permian) at a stratigraphic position much lower than the Barber County gypsum beds.

Salt.—Production of salt increased by 10.4% in volume and 9.9% in value over 1971 production. Salt was produced in Barton, Ellsworth, Reno, Rice, and Sedgwick Counties.

Sand and Gravel.—Production during 1972 decreased 2% in volume and 4% in value from the 1971 levels. There were 152 sand and gravel operations in 75 counties in the State. Of the total volume about 47% or 5.5 million tons, was used for paving purposes, while 36%, or 4.1 million tons, was used in building construction.

Leading counties in sand and gravel production were those counties in which large cities are located. Based on total volume produced, the leading counties were Wyandotte and Sedgwick.

Stone.—Production in 1972 declined 2.4% in volume; however, the value of production registered a 0.6% increase over the 1971 figures. About 96% of the total stone output was crushed limestone. The increasing use of limestone in pollution-abatement equipment should bring a reversal in the downward production trend experienced by quarry operators.

Table 11.—Kansas: Evaporated and rock salt sold or used by producers
(Thousand short tons and thousand dollars)

Year	Evaporated salt		Rock salt	
	Quantity	Value	Quantity	Value
1968	556	12,875	572	2,644
1969	623	13,810	648	3,280
1970	670	15,178	560	3,028
1971	676	15,847	564	2,865
1972	723	17,207	646	3,355

Table 12.—Kansas: Sand and gravel sold or used by producers, by class of operation and use
(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,928	4,098	3,888	4,158
Fill	960	551	1,254	907
Paving	3,408	3,314	2,652	2,781
Other uses [1]	181	217	128	167
Total [2]	8,472	8,180	7,923	8,013
Gravel:				
Building	179	293	163	275
Fill	76	75	169	124
Paving	1,094	1,160	816	866
Railroad ballast	10	11	W	W
Miscellaneous	207	247	166	269
Other uses	18	25	29	41
Total [2]	1,583	1,810	1,342	1,575
Government-and-contractor operations:				
Sand:				
Building	13	14	--	--
Fill	33	26	16	4
Paving	816	695	797	435
Total	862	735	813	439
Gravel:				
Building	105	60	67	43
Fill	38	39	23	16
Paving	765	518	1,200	715
Other uses	37	10	223	120
Total [2]	945	626	1,513	894
Total sand and gravel [2]	11,862	11,351	11,591	10,920

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes, railroad ballast, abrasives (1972), and other sands.

[2] Data may not add to totals shown because of independent rounding.

Table 13.—Kansas: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Barber	3	W	W	3	W	19
Barton	6	229	W	3	277	311
Butler	1	3	6	--	--	--
Chase	2	13	9	1	W	W
Cherokee	1	78	18	--	--	--
Cheyenne	3	102	W	2	W	W
Clark	1	34	16	1	22	11
Clay	2	191	W	2	W	104
Comanche	1	51	51	1	31	4
Cowley	6	291	262	6	335	279
Decatur	1	2	1	2	W	W
Dickinson	1	W	W	1	121	204
Doniphan	1	1	1	--	--	--
Douglas	2	218	W	2	472	W
Edwards	1	30	19	1	32	20
Elk	1	12	4	1	W	W
Ellis	5	237	198	3	176	196
Ellsworth	2	17	17	4	W	W
Franklin	1	4	3	--	--	--
Gove	4	W	W	2	33	5
Graham	1	20	10	1	21	11
Hamilton	1	19	10	1	W	W
Harper	2	73	W	2	W	W
Haskell	4	96	72	2	80	33
Hodgeman	1	89	45	1	W	W
Jackson	4	46	17	1	W	8
Jewell	--	--	--	1	11	4
Johnson	2	529	W	1	518	W
Kearny	3	70	W	1	W	16
Lane	1	86	18	1	W	W
Leavenworth	1	18	35	1	13	26
Lincoln	1	13	13	--	--	--
Logan	2	18	22	1	W	W
McPherson	1	23	34	1	10	4
Marshall	6	124	W	4	W	W
Meade	1	20	13	1	21	15
Morris	1	25	34	1	26	35
Nemaha	4	W	105	1	72	68
Neosho	1	76	W	1	89	W
Ness	1	19	24	1	W	W
Norton	2	40	43	1	25	26
Osborne	1	30	30	1	31	31
Ottawa	1	W	W	1	4	1
Pawnee	5	84	W	3	W	W
Phillips	4	86	101	2	39	41
Rawlins	3	W	W	1	W	3
Reno	9	397	280	7	435	342
Republic	2	113	W	1	98	86
Rice	4	141	96	2	W	W
Rush	--	--	--	1	39	22
Russell	2	60	59	1	W	33
Saline	3	235	W	1	297	W
Scott	1	30	22	1	31	23
Sedgwick	13	1,707	1,330	9	1,626	1,251
Shawnee	5	543	424	5	611	551
Sheridan	3	47	32	1	W	W
Sherman	3	56	72	3	65	99
Smith	1	21	5	1	22	6
Thomas	4	65	75	2	W	W
Trego	5	94	74	3	W	W
Wallace	1	4	4	--	--	--
Wyandotte	11	2,321	2,662	10	2,279	2,724
Undistributed [1]	[r] 60	2,960	4,987	36	3,625	4,306
Total [2]	226	11,862	11,351	152	11,591	10,920

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Cloud, Finney, Ford, Geary, Grant, Gray, Greeley (1972), Kingman, Kiowa, Lyon (1971), Marion (1971), Mitchell, Pottawatomie, Pratt, Riley, Rooks, Seward, Stafford, Sumner, Washington, Wichita, and some sand and gravel that can not be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 14.—Kansas: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Crushed and broken:				
Bituminous aggregate	1,681	2,721	1,613	3,051
Concrete aggregate	2,661	4,869	2,536	4,989
Dense graded road base stone	3,033	4,824	2,646	4,375
Macadam aggregate	356	559	W	W
Surface treatment aggregate	1,817	2,845	2,257	3,635
Unspecified construction aggregate and roadstone	706	963	830	1,593
Agricultural limestone	629	947	621	1,051
Cement	3,471	4,386	2,799	3,392
Riprap and jetty stone	318	630	921	1,233
Other uses [1]	238	446	325	531
Total [2]	14,908	23,190	14,547	23,849

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes filter stone (1971), whiting, stone sand (1971), railroad ballast, asphalt filler (1971), lime manufacture (1972), and uses not specified.

[2] Data may not add to totals shown because of independent rounding.

Table 15.—Kansas: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone total [1]	W	507	W	W
Crushed and broken:				
Limestone	14,349	22,227	13,962	22,886
Undistributed [2]	558	963	585	963
Total crushed	[3] 14,908	23,190	14,547	23,849

W Withheld to avoid disclosing individual company confidential data.

[1] Data include limestone and sandstone (1971).

[2] Includes sandstone, quartzite, and other stone.

[3] Data does not add to total shown because of independent rounding.

Table 16.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Ash Grove Cement Co.	1000 Tenmain Center Kansas City, Mo. 64105	Plant and quarry	Neosho.
General Portland Cement Co.	2800 Republic Bank Tower Dallas Tex. 75201	do	Wilson.
Lone Star Cement Corp.	2511 East 46th St., Suite "K" Indianapolis, Ind. 46205	do	Wyandotte.
The Monarch Cement Co.	Humboldt, Kans. 66748	do	Allen.
Universal Atlas Cement Co. Div. of U.S. Steel Corp.	600 Grant Street U.S. Steel Bldg. Pittsburgh, Pa. 15230	do	Montgomery.
Clays:			
Acme Brick Co.	Box 425 Fort Worth, Tex. 76101	Mine and plant	Cherokee and Ellsworth.
Ash Grove Cement Co.	1000 Tenmain Center Kansas City, Mo. 64105	do	Neosho.
Buildex, Inc	Box 62299 Pittsburg, Kans. 66762	do	Franklin and Ellsworth.
Cloud Ceramics	Box 417 Concordia, Kans. 66901	do	Cloud.
W. S. Dickey Clay Manufacturing Co.	1818 Commerce Tower Kansas City, Mo. 64105	do	Cherokee and Crawford.
Excelsior Clay Products, Inc.	842 North Waco Wichita, Kans. 67202	do	Wilson.
General Portland Cement Co.	Box 479 Fredonia, Kans. 66736	do	Do.
Humboldt Shale Mining Co.	Box 185 Humboldt, Kans. 66748	Mine	Allen.
Kansas Brick & Tile Co., Inc.	Box 126 Hoisington, Kans. 67544	Mine and plant	Barton.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays—Continued			
The Monarch Cement Co.	Humboldt, Kans. 66748	Mine and plant	Allen.
Universal Atlas Cement Co., Div. of U.S. Steel Corp.	Box 2969 Pittsburgh, Pa. 15230	do	Montgomery.
Wilkinsons, Inc	Rt. 1 Weir, Kans. 66781	Mine	Cherokee.
Coal:			
Clemens Coal Co	Box 62299 Pittsburg, Kans. 66762	Strip mine	Crawford.
Pittsburgh & Midway Coal Mining Co.	Tenmain Center Kansas City, Mo. 64105	do	Cherokee.
Wilkinsons, Inc	Rt. 1 Weir, Kans. 66781	do	Do.
Gypsum:			
Georgia-Pacific Corp., Gypsum Div.	900 Southwest 5th Portland, Oreg. 97204	Quarry and plant	Marshall.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Barber.
Lime:			
The Great Western Sugar Co.	Box 5308 Denver, Colo. 80217	Plant	Sherman.
Pumice:			
Ernest Hanzlicek	Wilson, Kans. 67490	Mine	Lincoln.
Stan Orr Construction Co.	P.O. Box 417 McPherson, Kans. 67460	do	Ellsworth.
Wyandotte Chemicals Corp.	1609 Biddle Ave. Wyandotte, Mich. 48192	Mine and plant	Norton.
Salt:			
American Salt Corp	3142 Broadway Kansas City, Mo. 64111	Wells and underground.	Rice.
Barton Salt Co	P.O. Box 1408 Hutchinson, Kans. 67501	Wells	Reno.
Carey Salt Co	1800 Carey Blvd. Hutchinson, Kans. 67501	Wells and underground.	Do.
Cargill, Inc	Cargill Bldg. Minneapolis, Minn. 55402	Wells	Barton.
Independent Salt Co	Box 36 Kanopolis, Kans. 67454	Underground	Ellsworth.
Morton Salt Co	110 North Wacker Drive Chicago, Ill. 60606	Wells	Reno.
Vulcan Materials Co., Chemicals Div.	Box 545 Wichita, Kans. 67201	Brine wells	Sedgwick.
Sand and gravel:			
John H. Alsop Sand Co.	Belleville, Kans. 66935	Stationary	Clay and Republic.
Builders Sand Co	78th & Holiday Drive Kansas City, Kans. 66106	3 stationary 2 dredge	Wyandotte.
Consumers Sand Co	924 West Railroad Street Topeka, Kans. 66088	Portable and 2 dredges.	Shawnee.
Holliday Sand & Gravel Co	6811 West 63rd Street Overland Park, Kans. 66202	Stationary and portable.	Wyandotte, Johnson, Douglas.
Miles Sand Inc	4857 North Meridian Wichita, Kans. 67204	Dredge	Sedgwick.
Peck-Woolf Sand & Material Co.	7301 Kaw Dr. Kansas City, Kans. 66111	do	Wyandotte.
Salina Sand Co., Inc	Mentor, Kans. 67465	Stationary	Saline.
Stewart Sand & Material Co.	4049 Penn. Ave. Kansas City, Mo. 64111	3 stationary	Wyandotte.
Superior Sand Co., Inc	6500 West 21st, Route 7 Wichita, Kans. 67212	Dredge	Sedgwick.
Wichita Big River Sand Co.	990 North Westlink Wichita, Kans. 67212	Stationary	Do.
Stone:			
Ash Grove Cement Co	1000 Tenmain Center Kansas City, Mo. 64105	Quarry	Johnson and Neosho.
N. R. Hamm Quarry, Inc.	Box 17 Perry, Kans. 66073	do	Jefferson, Leavenworth, Shawnee, Dickenson, Jackson, Marion, Morris Nemaha, Pottawatomie, Smith, Washington.
Holland Quarries	9131 Noland Rd. Lenexa, Kans. 66215	do	Johnson.
Ideal Cement Co	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Jewell.
Lone Star Cement Corp.	2511 East 46th St., Suite "K" Indianapolis, Ind. 46205	do	Wyandotte.
Midwest Minerals, Inc	Box 7 Girard, Kans. 66743	do	Various.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
G. M. Myers Inc	P.O. Box 911 El Dorado, Kans. 67042	Quarries	Butler.
Nelson Quarries Inc	Main Street La Harpe, Kans. 66751	do	Allen, Bourbon, Montgomery, Woodson.
Reno Construction Co	Box 4278 Overland Park, Kans. 66204	Quarry	Johnson.
Walker Stone Co	Box 247 Chapman, Kans. 67431	do	Dickinson.
Helium:			
Alamo Chemical Co., Gardner Cryogenics, Inc.	Elkhart, Kans. 67950	Plant	Morton.
Cities Service Cryogenics, Inc.	Scott City, Kans. 67871	do	Scott.
Cities Service Helex, Inc	Ulysses, Kans. 67880	do	Haskell.
Kansas Refined Helium Co	Otis, Kans. 67565	do	Rush.
National Helium Corp	Liberal, Kans. 67901	do	Seward.
Northern Helex Co	Bushton, Kans. 67427	do	Rice.
Petroleum operators:			
Amoco Production Co	Box 591 Tulsa, Okla. 74100		Various.
Cities Service Oil Co	Tulsa, Okla. 74100		Do.
Continental Oil Co	New York, N.Y. 10000		Do.
Derby Refining Co	Wichita, Kans. 67200		Sedgwick.
National Cooperative Refinery Association.	McPherson, Kans. 67460		Various.
Skelly Oil Co	Tulsa, Okla. 74100		Do.
Texaco, Inc	New York, N.Y. 10000		Do.
Petroleum refineries:			
American Petrofina Co. of Texas.	El Dorado, Kans. 67042	Refinery	Butler.
Apco Oil Corp	Arkansas City, Kans. 67005	do	Cowley.
CRA, Inc	Coffeyville, Kans. 67337	do	Montgomery.
	Philipsburg, Kans. 67661	do	Phillips
Derby Refinery Co	Wichita, Kans. 67200	do	Sedgwick.
Mid-American Refining Co., Inc.	Chanute, Kans. 66720	do	Neosho.
Mobil Oil Co	Augusta, Kans. 67010	do	Butler.
National Cooperative Refinery Association.	McPherson, Kans. 67460	do	McPherson.
Phillips Petroleum Co	Kansas City, Kans. 66100	do	Wyandotte.
Skelly Oil Co	El Dorado, Kans. 67042	do	Butler.
Northern American Petroleum Corp.	Scott City, Kans. 67871	do	Scott.
Natural gas purchasers:			
Cities Service Gas Co	Okla. City, Okla. 73100		Various.
Colorado Interstate Gas Co.	Colorado Springs, Colo. 80900.		Do.
Kansas-Nebraska Natural Gas Co.	Hastings, Nebr. 68901		Do.
Northern Natural Gas Co.	Omaha, Nebr. 68100		Do.
Panhandle Eastern Pipeline Co.	Houston, Tex. 77000		Do.

The Mineral Industry of Kentucky

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Kentucky for collecting information on all minerals.

By H. L. Riley [1] and Preston McGrain [2]

The value of mineral production in Kentucky increased 5.5% to $977 million. In 1972 coal production accounted for 84.4% of this value. Kentucky ranked second among the States in the production of bituminous coal with 20.4% of the national total. One hundred twenty-one million tons of bituminous coal, valued at $824.7 million, were mined.

Government Programs.—The U.S. Geological Survey, in cooperation with the Kentucky Geological Survey continued to map areal geology of the State on 7.5-minute quadrangle maps. A total of all or parts of 431 quadrangles have been published.

The Kentucky Geological Survey published three reports and three maps on geology and mineral resources.[3]

Table 1.—Mineral production in Kentucky[1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays [2] thousand short tons	956	$1,377	920	$1,406
Coal (bituminous) do	119,889	774,735	121,188	824,691
Natural gas million cubic feet	72,723	18,253	63,648	15,976
Petroleum (crude) thousand 42-gallon barrels	10,692	35,925	9,702	32,599
Sand and gravel thousand short tons	8,202	11,061	8,485	11,967
Stone [3] do	32,514	52,296	34,279	59,690
Zinc short tons	5,268	1,696	1,780	682
Value of items that cannot be disclosed:				
Ball clay, cement, fluorspar, lime, natural gas liquids, and stone (quartzite)	XX	30,542	XX	29,949
Total	XX	925,885	XX	976,910
Total 1967 constant dollar	XX	787,280	XX	[p] 812,691

[p] Preliminary. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes ball clay, included with "Value of items that cannot be disclosed."

[3] Excludes quartzite, included with "Value of items that cannot be disclosed."

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[1] Mining engineer, Division of Fossil Fuels—Mineral Supply.

[2] Assistant State Geologist, Kentucky Geological Survey, Lexington, Ky.

[3] Denver, G. R., Jr. Oil and Gas Exploration Map, Nelson County, Kentucky. Kentucky Geol. Survey, ser. 10, scale 1:24,000, 1972.

Kentucky Geological Survey. Proceedings of the Technical Sessions Kentucky Oil and Gas Association, 34th and 35th Annual meetings, 1970 and 1971. Kentucky Geol. Survey, ser. 10, Spec. Pub. 21, 1972, 80 pp.

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Schwalb, H. R., E. N. Wilson, and D. G. Sutton. Oil and Gas Map of Kentucky (Sheet 1, Western Part). Kentucky Geol. Survey, ser. 10, scale 1:250,000, 1971.

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Kentucky Geological Survey. Sedimentation of the Mississippian Knifley Sandstone and Cane Valley Limestone in South central Kentucky. Ser. 10, RI 13, 1972, 30 pp.

Table 2.—Value of mineral production in Kentucky, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972, in order of value
Adair	W	W	Petroleum, stone.
Allen	W	W	Stone, petroleum.
Anderson	W	W	Stone.
Ballard	(2)	W	Sand and gravel.
Barren	W	W	Stone, petroleum.
Bath	W	$365	Do.
Bell	$23,102	24,304	Coal, petroleum.
Boone	W	W	Sand and gravel, stone.
Boyd	1,155	1,429	Coal, clays, petroleum.
Boyle	W	W	Stone.
Breathitt	25,249	39,885	Coal, petroleum.
Breckinridge	508	W	Stone, sand and gravel, petroleum.
Bullitt	W	W	Stone, clays.
Butler	1,815	1,564	Coal, stone, petroleum.
Caldwell	W	W	Stone.
Calloway	202	W	Sand and gravel.
Campbell	--	W	Stone, sand and gravel.
Carlisle	2	W	Sand and gravel.
Carter	2,308	3,023	Coal, stone, clays.
Casey	382	W	Stone, petroleum.
Christian	2,962	3,858	Stone, petroleum, coal.
Clay	5,035	2,788	Coal, petroleum.
Clinton	W	W	Coal, stone, petroleum.
Crittenden	W	W	Fluorspar, stone.
Cumberland	W	W	Petroleum, stone.
Daviess	10,111	8,975	Coal, petroleum, sand and gravel, clays.
Edmonson	W	W	Coal, stone, petroleum.
Elliott	W	W	Coal, petroleum.
Estill	W	W	Petroleum, stone.
Fayette	W	W	Stone.
Fleming	W	W	Do.
Floyd	27,951	31,748	Coal, natural gas liquids, petroleum.
Franklin	W	W	Stone, sand and gravel.
Fulton	137	W	Sand and gravel.
Gallatin	W	W	Do.
Garrard	165	W	Stone.
Graves	W	W	Clays, sand and gravel.
Grayson	W	W	Stone.
Green	W	W	Stone, petroleum.
Greenup	358	873	Coal, clays, stone, petroleum, sand and gravel.
Hancock	962	656	Clays, petroleum, coal.
Hardin	1,244	1,312	Stone.
Harlan	81,808	95,188	Coal, stone.
Harrison	W	W	Stone.
Hart	W	W	Stone, sand and gravel, petroleum.
Henderson	6,099	6,394	Petroleum, sand and gravel, coal.
Henry	W	W	Stone.
Hickman	(2)	7	Sand and gravel.
Hopkins	70,823	67,297	Coal, petroleum, clays.
Jackson	W	W	Coal, stone.
Jefferson	W	15,320	Cement, stone, sand and gravel, clays.
Jessamine	W	--	
Johnson	15,249	12,344	Coal, petroleum.
Knott	25,487	25,919	Do.
Knox	8,859	4,755	Do.
Laurel	3,308	3,285	Coal, stone, petroleum.
Lawrence	2,580	2,425	Coal, petroleum.
Lee	6,112	W	Petroleum, stone, coal.
Leslie	12,776	14,051	Coal, petroleum.
Letcher	W	W	Coal, stone, petroleum.
Lewis	--	W	Clays.
Livingston	10,460	12,550	Stone, sand and gravel, zinc.
Logan	W	W	Stone, petroleum.
McCracken	W	W	Sand and gravel.
McCreary	5,348	8,057	Coal, petroleum.
McLean	W	6,706	Do.
Madison	W	W	Stone.
Magoffin	5,341	2,988	Coal, petroleum.
Marion	238	W	Stone, petroleum.
Marshall	1,389	(2)	Sand and gravel.
Martin	12,062	17,989	Coal, sand and gravel, petroleum.
Mason	W	W	Sand and gravel.
Meade	W	W	Natural gas liquids, stone.
Menifee	W	W	Stone.
Mercer	W	W	Do.
Metcalfe	W	W	Stone, petroleum.
Monroe	308	W	Do.
Montgomery	172	W	Stone.
Morgan	4,960	W	Coal, stone, clays, petroleum.

See footnotes at end of table.

Table 2.—Value of mineral production in Kentucky, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972, in order of value
Muhlenberg	$103,239	$126,452	Coal, petroleum, stone.
Nelson	W	W	Stone.
Nicholas	W	940	Do.
Ohio	28,395	36,117	Coal, stone, petroleum.
Oldham	1,217	W	Stone, sand and gravel.
Owsley	W	W	Coal, petroleum.
Pendleton	W	W	Lime, stone.
Perry	48,923	37,396	Coal, petroleum.
Pike	W	W	Coal, stone, petroleum.
Powell	W	W	Stone, petroleum, clays.
Pulaski	4,181	5,148	Coal, stone, petroleum.
Rockcastle	W	W	Stone, coal.
Rowan	W	W	Stone, clays.
Russell	([2])	19	Sand and gravel, petroleum.
Scott	W	W	Stone.
Shelby	34	--	
Simpson	W	W	Stone, petroleum.
Taylor	W	W	Stone.
Todd	W	W	Stone, petroleum.
Trigg	W	W	Stone.
Trimble	W	W	Sand and gravel.
Union	21,460	32,188	Coal, petroleum, sand and gravel.
Warren	1,399	W	Stone, petroleum.
Washington	W	W	Stone.
Wayne	W	W	Stone, coal, petroleum.
Webster	8,384	12,582	Coal, petroleum.
Whitley	6,369	W	Coal, clays, petroleum.
Wolfe	481	570	Petroleum, stone.
Undistributed [3]	325,283	309,966	
Total [4]	925,885	976,910	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Bourbon, Bracken, Carroll, Clark, Grant, Kenton, Larue, Lincoln, Lyon, Owen, Woodford.

[2] Less than ½ unit.

[3] Includes natural gas, some sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Kentucky business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total nonagricultural employment ...thousands	931.9	987.8	+6.0
Mining ...do	29.9	31.8	+6.4
Contract construction ...do	50.0	54.4	+8.8
Service ...do	138.2	145.4	+6.0
Government ...do	180.5	189.6	+5.0
Manufacturing ...do	251.1	266.3	+6.0
Personal income:			
Total ...millions	$10,830	$11,878	+9.7
Per capita	$3,306	$3,601	+8.9
New business incorporations	4,200	NA	--
Construction activity:			
Housing units—private and public:			
Number	24,080	23,877	−0.8
Value of nonresidential construction ...millions	$111.5	$110.9	−.5
Cement shipments to and within Kentucky:			
Portland ...thousand short tons	1,083	1,125	+3.9
Masonry ...do	97	104	+7.2
Farm marketing receipts ...millions	$949.4	$1,122.2	+18.2
Mineral production value ...do	$925.9	$976.9	+5.5
Electrical energy sales (sales to AEC excluded) million kilowatt-hours	15,823	NA	--

p Preliminary. NA Not available.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-fatal	Frequency	Severity
1971:								
Coal	25,020	213	5,337	41,896	43	1,871	45.68	NA
Metal	24	326	8	63	--	8	127.85	3,308
Nonmetal	529	286	125	1,002	--	54	53.92	1,262
Sand and gravel	376	268	101	904	1	21	24.33	7,050
Stone	2,253	260	585	5,006	1	195	39.16	2,183
Total	28,202	218	6,156	[1] 48,870	45	2,149	44.90	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	10	139	1	11	--	2	180.03	900
Nonmetal	320	239	77	615	1	59	97.61	13,688
Sand and gravel	380	267	101	907	--	18	14.33	584
Stone	1,830	251	460	3,882	3	108	28.59	5,239
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data does not add to total shown because of independent roundings.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Production of coal increased 1.5% and its value increased 6.4% compared with 1971 data. Coal production was 121.2 million tons valued at $824.67 million for an average value of $6.81 per ton compared with $6.48 per ton in 1971. Bituminous coal was produced at 1,458 mines in 42 counties. In 1971, 1,745 mines operated in 42 counties. Muhlenberg and Pike Counties produced 26.1 million tons and 19.1 million tons of coal, and had the largest production in western and eastern Kentucky coal fields, respectively.

In eastern Kentucky, 1,355 mines in 30 counties produced 68.9 million tons of coal valued at $8.01 per ton. In 1971, 1,625 mines also in 30 counties produced 71.6 million tons valued at $7.60 per ton. Of the coal mined in eastern Kentucky 670 underground mines produced 38.0 million tons or 55.1%. Surface mines produced 30.9 million tons, or 44.9% of the total.

Equipment used at eastern Kentucky underground mines was estimated to include 550 cutting machines, which undercut 22.8 million tons, 542 handheld coal drills, 143 mobile coal drills, 188 rotary drills, and 57 percussion rock drills.

Of the total eastern underground production, 95.7%, or 36.3 million tons, was mechanically loaded. Of this tonnage 65.0%, 23.6 million tons, was loaded by 527 mobile loaders. An additional nine mobile loaders were used in conjunction with continuous miners. A total of 139 continuous miners produced 12.7 million tons, or 35.0%, of the underground tonnage mechanically mined.

Underground mine haulage units included 167 trolley-type locomotives, 74 battery-powered locomotives, 67 shuttle buggies, 507 rubber-tired tractors, 582 cable-type shuttle cars, 179 battery-type shuttle cars, and 349 gathering conveyors.

A total of 120 draglines, or power shovels, were used in eastern Kentucky; 108 had dipper or bucket capacities of 5 cubic yards or less. Reportedly, 183 bulldozers and 135 front-end loaders were also used.

Of the total coal produced in the eastern Kentucky coal-field, 20.3 million tons were cleaned at 32 cleaning plants. Rail and water transportation accounted for 92.8% of total shipments. Unit trains transported 14% of the coal produced.

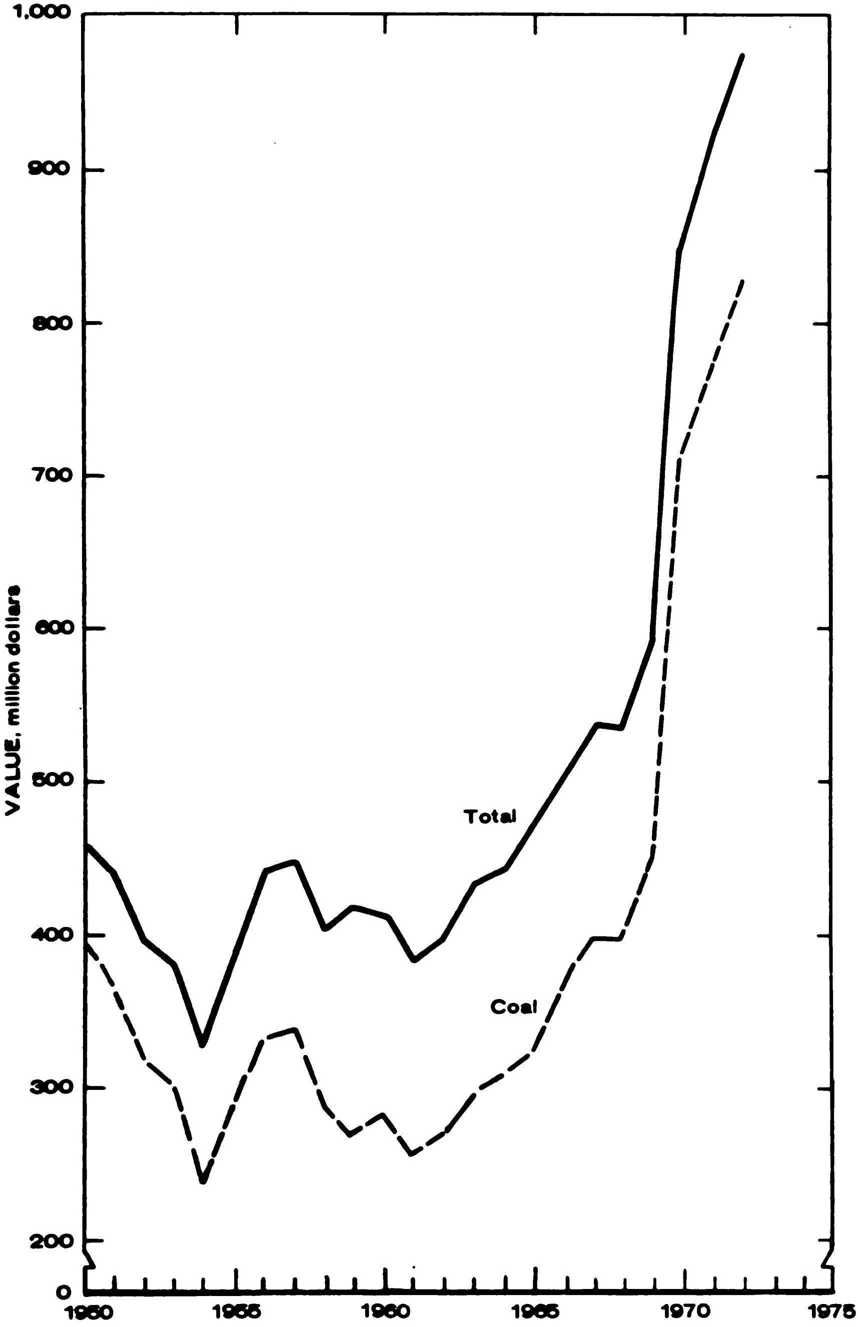

Figure 1.—Value of coal and total value of mineral production in Kentucky.

Table 5.—Kentucky: Bituminous coal production, by type of mine and county—Continued

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total[1]	
Eastern:									
Bell	15	27	15	57	700	2,666	338	3,704	$24,304
Boyd	--	5	2	7	--	177	36	213	1,328
Breathitt	--	32	16	48	--	4,260	1,867	6,127	39,841
Carter	--	13	3	16	--	280	54	334	1,941
Clay	11	11	5	27	135	234	84	453	2,748
Clinton	--	1	--	1	--	62	--	62	W
Elliott	--	1	--	1	--	53	--	53	W
Floyd	107	20	14	141	2,520	1,239	507	4,266	25,428
Greenup	--	2	2	4	--	32	13	45	272
Harlan	67	36	31	134	7,375	1,328	705	9,408	94,876
Jackson	--	2	1	3	--	41	11	52	W
Johnson	12	17	5	34	208	1,623	335	2,166	11,786
Knott	48	18	13	79	2,746	436	225	3,408	25,895
Knox	5	24	7	36	22	636	119	777	4,745
Laurel	--	11	5	16	--	407	58	466	3,094
Lawrence	--	6	4	10	--	247	71	318	1,928
Lee	1	--	--	1	17	--	--	17	W
Leslie	12	18	9	39	1,325	362	182	1,869	14,044
Letcher	75	47	30	152	2,849	1,486	921	5,256	39,836
McCreary	5	3	1	9	917	106	12	1,035	8,054
Magoffin	2	7	3	12	10	417	11	438	2,340
Martin	12	14	4	30	1,750	674	122	2,546	17,769
Morgan	--	3	--	3	--	150	--	150	1,414
Owsley	--	1	1	2	--	28	13	41	W
Perry	37	34	18	89	2,522	1,572	954	5,049	36,754
Pike	251	65	42	358	14,680	2,430	2,020	19,130	182,243
Pulaski	2	3	--	5	17	447	--	464	2,942
Rockcastle	--	1	--	1	--	20	--	20	W
Wayne	--	3	1	4	--	11	2	13	77
Whitley	8	21	7	36	152	707	119	977	6,126
Undistributed[2]	--	--	--	--	--	--	--	--	1,469
Total	670	446	239	1,355	37,946	22,131	8,780	68,858	551,252
Western:									
Butler	2	4	1	7	71	93	39	203	1,072
Christian	--	3	--	3	--	80	--	80	387
Daviess	--	2	--	2	--	1,012	--	1,012	5,930
Edmonson	--	1	--	1	--	160	--	160	W
Hancock	--	1	--	1	--	38	--	38	W
Henderson	1	--	--	1	87	--	--	87	W
Hopkins	10	21	2	33	5,508	5,163	52	10,723	64,919
McLean	--	3	--	3	--	1,106	--	1,106	4,828
Muhlenberg	6	16	2	24	5,101	20,939	46	26,086	124,910
Ohio	1	19	--	20	1,536	4,933	--	6,469	32,248
Union	6	--	--	6	4,944	--	--	4,944	27,507
Webster	1	1	--	2	1,300	121	--	1,421	10,166
Undistributed[2]	--	--	--	--	--	--	--	--	1,472
Total	27	71	5	103	18,547	33,645	137	52,830	273,439
Grand total	697	517	244	1,458	56,493	55,776	8,917	121,188	824,691

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Data may not add to total shown because of independent rounding.

[2] Includes values indicated by symbol W.

In the western Kentucky coal field, 103 mines in 12 counties produced 52.3 million tons of coal. Strip mines produced 64.3% of the coal, and underground mines produced 35.4%. Only five augers were in operation and produced less than 0.3% of the coal. Seventeen percent of the coal produced was used at a mine-mouth steam electric generating plant.

In the 27 western underground mines, equipment included 99 cutting machines, 94 mobile handheld power drills, 130 mobile loading machines, three continuous miners, 209 cable-type shuttle cars, and 17 battery-operated shuttle cars. All reported production was mechanically loaded. The continuous miners produced only a minor percentage of the underground tonnage.

Table 6.—Kentucky: Crude oil production by county

(Thousand 42-gallon barrels and thousand dollars)

County	1971	1972
Adair	368	326
Allen	39	36
Barren	12	11
Bath	3	1
Bell	(1)	(1)
Boyd	1	3
Breathitt	16	13
Breckinridge	18	18
Butler	47	60
Casey	9	7
Christian	178	152
Clay	6	9
Clinton	27	27
Cumberland	24	27
Daviess	887	720
Edmonson	1	(1)
Elliott	32	28
Estill	189	161
Floyd	27	24
Green	63	45
Greenup	1	1
Hancock	72	64
Hart	15	13
Henderson	1,443	1,191
Hopkins	828	707
Johnson	205	166
Knott	7	7
Knox	3	3
Laurel	2	2
Lawrence	180	148
Lee	1,622	1,700
Leslie	2	2
Letcher	226	190
Logan	1	1
McCreary	2	1
McLean	551	559
Magoffin	236	193
Marion	(1)	(1)
Martin	11	9
Metcalfe	71	26
Monroe	19	16
Morgan	3	1
Muhlenberg	300	253
Ohio	329	276
Owsley	1	1
Perry	171	191
Pike	28	32
Powell	33	22
Pulaski	1	1
Russell	(1)	1
Simpson	12	10
Todd	1	1
Union	1,631	1,869
Warren	20	22
Wayne	3	9
Webster	651	719
Whitley	9	7
Wolfe	55	120
Total	10,692	9,702
Value	35,925	32,599

(1) Less than 500 barrels.

Sources: Quantity—Kentucky Geological Survey; Value—Bureau of Mines.

Equipment used at 71 strip mines included 111 power shovels. Of these, 66 had a dipper capacity of 5 cubic yards or less; 32 had dipper capacities of 6 to 15 cubic yards; 8 had dipper capacities of 16 to 50 cubic yards; and 5 had a dipper capacity in excess of 50 cubic yards. Thirty-six draglines were reported in use. Of these, 12 used buckets of up to 5 cubic yards; 9 had 6 to 15 cubic-yard buckets; 10 had bucket capacities of 16 to 50 cubic yards; and 5 had bucket capacities of more than 50 cubic yards. Other equipment included 223 bulldozers; 100 front-end loaders; 8 carryall scrapers; and 8 horizontal and 69 vertical drills for use on overburden.

Coal deliveries to the Tennessee Valley Authority's (TVA) steam electric generating plants during TVA's 1972 fiscal year included 18.6 million tons from western Kentucky and 4.8 million tons from eastern Kentucky.

Natural Gas Liquids.—The quantity of natural gas decreased from 72,723 million cubic feet valued at $18,253,000 in 1971 to 63,648 million cubic feet valued at $15,976,000 in 1972. Total value decreased 12.4%. The average wellhead value in 1972 was 25.1 cents per thousand cubic feet. The reported number of gas wells producing at yearend was 7,099.

Natural Gas Liquids.—The quantity of natural gasoline and cycle products decreased 0.3% while the value increased 2.7%. Production of liquefied petroleum gases (LPG) and ethane decreased 9.5% in both quantity and value.

Petroleum.—Crude oil production, overall, has decreased since 1959, the record year. Crude oil production in 1972 declined to 9,702,000 42-gallon barrels valued at $32,599,000, a reduction of 9.3% in both volume and value from 1971.

The number of oil wells producing at yearend was reported to be 14,616. The crude oil production by county is listed in table 6. The number of oil and gas wells, and the footage drilled are shown in table 7. A total of 200 proved field oil wells and 148 proved field gas wells were drilled during 1972. Thirty exploratory oil wells and 18 exploratory gas wells were drilled.

NONMETALS

Nonmetals provided 9.4% of the total value of mineral production in Kentucky in 1972.

Cement.—Kosmos Cement, subsidiary of the Flintkote Co., operated in Jefferson County, the State's only cement plant. Most of the cement shipped was used in ready-mix concrete products and other masonry building materials. Raw materials used in making portland cement included limestone, clay, gypsum, and iron-bearing materials.

Table 7.—Kentucky: Oil and gas well drilling completions in 1972, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Adair	45	--	13	6	--	18	82	125,619
Allen	2	--	3	4	--	8	17	4,924
Barren	9	--	6	2	--	7	24	9,042
Bath	--	--	1	--	--	--	1	550
Bell	--	1	1	--	--	--	2	6,421
Boyd	--	--	1	--	--	--	1	8,252
Breckinridge	--	--	6	--	--	1	22	41,089
Breathitt	--	20	1	--	--	3	9	4,782
Bullitt	--	--	--	--	--	1	1	1,569
Butler	7	--	8	1	--	3	19	11,504
Carter	--	--	--	--	--	1	1	9,980
Christian	1	--	--	--	--	2	3	1,905
Clark	--	--	--	--	--	1	1	4,690
Clay	--	2	1	--	3	--	6	6,222
Clinton	1	--	1	1	--	5	8	8,867
Crittenden	--	--	--	--	--	2	2	2,011
Cumberland	6	--	10	4	--	9	29	31,183
Daviess	17	8	29	--	2	7	63	64,684
Elliott	3	--	1	--	--	--	4	2,938
Estill	--	--	--	--	--	1	1	815
Floyd	--	7	3	--	--	--	10	20,398
Grayson	--	1	--	--	--	--	1	1,464
Green	6	--	2	--	--	3	11	6,689
Hancock	2	--	11	--	--	1	14	9,490
Hardin	--	2	--	--	--	3	5	8,915
Hart	--	--	1	--	--	2	3	2,168
Henderson	7	--	11	2	--	6	26	51,974
Hopkins	6	5	8	1	--	12	32	68,417
Johnson	--	--	1	--	1	--	2	5,344
Knott	--	6	1	--	2	--	9	25,229
Knox	--	1	4	--	2	2	9	14,472
Larue	--	--	--	--	--	1	1	835
Laurel	--	--	--	--	--	1	1	85
Lawrence	5	2	3	--	--	1	11	22,216
Lee	10	--	--	--	--	--	10	10,442
Leslie	--	5	4	--	--	--	9	21,710
Letcher	4	19	--	--	--	--	23	80,884
Lincoln	--	--	--	--	--	1	1	1,353
Logan	--	--	--	--	--	3	3	1,880
McCreary	--	--	--	--	1	5	6	6.542
McLean	8	1	4	1	1	3	18	38,712
Magoffin	3	2	--	--	1	--	6	7,070
Marion	2	--	2	--	--	1	5	858
Martin	--	12	1	--	--	--	13	30,679
Menifee	--	--	1	--	--	--	1	912
Metcalfe	1	--	5	--	--	14	20	8,594
Monroe	3	--	4	2	--	3	12	8,297
Morgan	--	2	--	--	--	--	2	3,651
Muhlenberg	4	--	4	--	--	4	12	16,188
Nelson	--	--	--	--	--	1	1	1,683
Ohio	10	2	13	1	2	8	36	34,331
Perry	1	27	3	--	--	--	31	98,697
Pike	--	21	3	--	1	--	25	85,217
Powell	10	--	--	--	--	--	10	10,547
Pulaski	--	--	1	--	--	--	1	1,825
Rowan	--	--	--	--	--	1	1	4,977
Russell	1	--	5	1	--	10	17	20,330
Simpson	5	--	3	2	--	3	13	7,290
Todd	--	--	--	--	--	2	2	1,692
Union	2	--	2	--	--	1	5	12,820
Warren	1	--	--	--	--	1	2	1,139
Wayne	1	--	--	--	--	4	5	2,766
Webster	13	--	6	1	--	1	21	46,494
Whitley	--	2	--	--	2	4	8	12,076
Wolfe	4	--	--	1	--	1	6	7,685
Total	200	148	188	30	18	172	756	1,156,429

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[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 8.—Kentucky: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Ballard	1	6	(1)	1	W	W
Boone	4	850	965	3	1,289	1,454
Breckinridge	1	55	52	1	W	W
Calloway	2	76	202	2	W	W
Carlisle	1	24	2	1	W	W
Fulton	2	84	137	2	W	W
Greenup	1	W	W	1	W	1
Hart	1	W	W	1	86	129
Hickman	1	7	(1)	1	7	7
Jefferson	3	2,004	3,087	2	W	W
Marshall	1	5	(1)	1	113	190
Martin	1	W	W	1	W	(1)
Russell	--	--	--	1	12	16
Union	1	24	26	2	W	W
Undistributed [2]	r 28	r 5,066	r 6,590	19	6,979	10,170
Total [3]	48	8,202	11,061	39	8,485	11,967

r Revised.

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Campbell (1972), Daviess, Floyd (1971), Franklin (1972), Gallatin, Graves, Henderson, Livingston, McCracken, Mason, Oldham (1972), Trimble, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

Table 9.—Kentucky: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,564	5,027	3,222	4,912
Fill	971	878	704	661
Paving	1,784	2,303	2,129	2,954
Other uses [1]	78	317	187	254
Total [2]	6,397	8,520	6,241	8,781
Gravel:				
Building	820	1,271	963	1,599
Fill	18	20	174	123
Paving	782	1,197	944	1,351
Miscellaneous	--	--	(3)	65
Other uses	15	16	--	--
Total [2]	1,634	2,503	2,080	3,138
Government-and-contractor operations:				
Sand:				
Fill	24	24	--	--
Paving	--	--	24	24
Total [2]	24	24	24	24
Gravel:				
Building	2	1	--	--
Fill	145	13	--	--
Paving	--	--	139	24
Total [2]	147	14	139	24
Total sand and gravel [2]	8,202	11,061	8,485	11,967

[1] Includes blast, foundry, railroad ballast (1971), fire or furnace (1971), and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Included with fill gravel to avoid disclosing individual company confidential data.

Preliminary figures indicate that in 1972 portland cement consumed in the State totaled 1,124,941 short tons; masonry cement used in the State was 104,350 short tons.

Clays.—Two companies mined ball clay from three open pits in Graves County. This clay was mined, processed, and packaged or shipped in bulk to manufacturers of pottery ware, floor and wall tile, for use as paper fillers, refractory ware, and firebrick.

Eleven companies at 14 open pits produced 81,000 tons of fire clay valued at $518,000 from Carter, Greenup, Lewis, and Rowan Counties. Most of the clay was used to manufacture firebrick and other refractories.

Fourteen companies at 15 open pits mined 839,000 tons of common clay and shale valued at $888,000. Production increased slightly and value increased 5%.

Fluorspar.—One mine produced fluorspar in Crittenden County. Most of the fluorspar was used in the production of hydrofluoric acid. Four associated companies have developed a large fluorspar ore body. Cerro Corp. and three partners—Frontier Resources, Inc.; Five Resources, Inc., and J. Fred Landers—announced that 1 million tons of 40% fluorspar ore had been developed by a diamond drilling program. A new underground mine and a 500-ton-per-day fluorspar mill was under construction at the deposit in Crittenden County.

Graphite (Synthetic).—Graphite was manufactured in Fulton County for use in anodes and electrodes. Production was substantially the same as in 1971.

Lime.—Black River Mining Co. produced lime in Pendleton County for use at other locations for BOF steel furnaces and for water purification. Output increased 17% over that of 1971, the initial production year. Total lime consumption in Kentucky was 485,500 tons.

Mullite.—Synthetic mullite was produced by Charles Taylor and Son, Co. in Greenup County.

Perlite.—Crude perlite mined in the western States was expanded at plants in Boone and Campbell Counties for use in roof insulation, industrial board, plaster aggregates, soil conditioning, and concrete plaster. Shipments and value were increased 7.6% and 5.9%, respectively, above those in 1971.

Vermiculite.—Crude vermiculite mined in other States was exfoliated at a plant in Campbell County. Shipments increased 3%, and value increased 20%. The product was used in loose fill insulation, in lightweight concrete, and as a plaster aggregate.

Sand and Gravel.—Commercial and Government contracted sand and gravel was mined at 43 operations in 25 counties. At commercial operations, a total of 6,241,000 tons of sand valued at $8,781,000 was mined, and 2,080,000 tons of gravel valued at $3,138,000 was produced. Total production of sand and gravel increased 3%. Total value increased 9%.

End uses were primarily building and paving.

Stone.—Crushed limestone production amounted to 34,279,000 tons valued at $59,690,000 in 1972, increasing 9.3% in tonnage and 17.1% in value. Eighty-two producers including one Federal and three county agencies mined and crushed limestone at 118 quarries and underground mines in 68 counties. Of the total stone produced, 82% was used for concrete and roads; 7% for aglime; and 11% for other uses.

Principle producers of crushed limestone were as follows: Reed Crushed Stone Co., Inc.; Three Rivers Rock Co.; Vulcan Materials Co.; Marble Cliff Quarries Co.; Martin-Marietta Materials Co. and Geoghegan & Mathis, Inc.

Quartzite was mined and crushed at one quarry near Smithland in Livingston County for use in the manufacture of ferrosilicon.

METALS

The value of metallic ores was less than one-half of 1% of the total value of mineral production.

Aluminum-Primary.—The National Southwire Co. smelted alumina at a plant near Hawesville, in Hancock County. Production increased 4.2% over that of 1971, while the value decreased 9%.

Anaconda Aluminum Co. announced a new smelter is under construction near Sebree in Henderson County at an investment of over $100 million. The plant site is adjacent to the Green River, and alumina will be barged to the plant. The plant's planned capacity is 120,000 short tons of aluminum per year.

Ferroalloys.—Ferroalloy shipments and value were substantially the same as in 1971. Value did not increase owing to imports. The main use was in steel manufacture.

Pig Iron.—Production of pig iron increased 9%, and total value increased 28%. Armco Steel Corp. produced both basic and foundry pig iron at its Ashland plant.

Zinc.—Production of zinc sulfide ores contained 1,780 tons of zinc in 1972 compared with 5,268 tons in 1971. One mine closed in March 1972. Most of the zinc concentrate was shipped to smelters at Bartlesville, Oklahoma and Amarillo, Tex.

Table 10.—Kentucky: Crushed limestone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Bath	1	144	W	1	281	W
Carter	4	571	890	4	586	944
Casey	1	195	352	1	W	W
Christian	3	1,019	1,426	3	W	W
Garrard	1	97	165	1	76	W
Hardin	5	800	1,244	5	834	1,312
Harlan	1	W	W	1	178	312
Hart	1	198	W	1	100	W
Jefferson	5	1,828	3,049	5	1,823	3,280
Livingston	7	4,447	6,307	2	W	W
Marion	1	118	288	2	W	W
Marshall	3	694	1,389	--	--	--
Menifee	1	143	W	1	W	W
Monroe	1	W	244	1	W	W
Montgomery	1	119	178	1	W	W
Morgan	4	360	630	3	313	551
Nicholas	1	W	W	1	895	940
Oldham	4	806	1,217	4	947	1,485
Pulaski	2	W	W	3	1,295	2,198
Trigg	1	201	W	1	201	W
Warren	4	809	1,332	4	W	W
Wolfe	1	W	W	1	93	167
Undistributed[1]	72	18,807	32,313	72	26,657	48,602
Total[2]	125	31,358	50,969	118	34,279	59,690

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Adair, Allen, Anderson, Barren (1971), Boone (1972), Boyle, Breckinridge, Bullitt, Butler, Caldwell, Campbell (1972), Clinton, Crittenden, Cumberland, Edmonson, Estill, Fayette, Fleming, Franklin, Grayson, Green, Greenup, Harrison, Henry, Jackson, Jessamine (1971), Laurel, Lee, Letcher, Logan, Madison, Meade, Mercer, Metcalfe, Muhlenberg, Nelson, Ohio, Pendleton, Pike, Powell, Rockcastle, Rowan, Scott, Simpson, Taylor, Todd, Washington and Wayne Counties.

[2] Data may not add to totals shown because of independent rounding.

Table 11.—Kentucky: Crushed limestone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Bituminous aggregate	3,417	5,887	3,580	6,358
Concrete aggregate	4,398	7,237	6,496	10,758
Dense graded roadbase stone	8,427	13,625	8,926	15,003
Macadam aggregate	1,168	2,046	866	1,642
Surface treatment aggregate	1,419	2,486	1,649	2,905
Unspecified construction aggregate and roadstone	3,090	5,081	6,456	11,242
Agricultural limestone	1,779	3,046	2,318	3,963
Fill	W	W	289	336
Railroad ballast	312	425	332	638
Riprap and jetty stone	3,409	4,677	1,611	3,518
Other uses[1]	3,938	6,506	1,756	3,327
Total[2]	31,358	50,969	34,279	59,690

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes stone used in cement and lime manufacture, building products, flux (1971), filter (1972), mine dusting, ferrosilicon (1972), and uses not specified.

[2] Data may not add to totals shown because of independent rounding.

Table 12.—Principal producers

Commodity and company	Address	Type of activity	County
Aluminum, primary: National Southwire Aluminum Co.	P.O. Box M Hawesville, Ky. 42348	Smelter	Hancock.
Cement, masonry and portland:			
Kosmos Cement, Division of The Flintkote Co.	Dixie Highway Kosmosdale, Ky. 40272	Plant	Jefferson.
Clays:			
Ball:			
Kentucky-Tennessee Clay Co.	Box 77 Mayfield, Ky. 42066	3 open pit mines and plant.	Graves.
Old Hickory Clay Co	Box 271 Paducah, Ky. 42351	2 open pit mines.	Do.
Fire:			
Ford Burchett Clay Co.	Olive Hill, Ky. 41164	Open pit mine	Carter.
Burge & Gultz Clay Co.	Route 2 Olive Hill, Ky. 41164	do	Do.
General Refractories Co	1520 Locust St. Philadelphia, Pa. 19102	4 open pit mines and plant.	Carter and Rowan.
M.A. McCoy & Son	Oak Hill, Ohio 45656	2 open pit mines	Greenup.
Miscellaneous:			
American Olean Tile Co	Lewisport, Ky. 42351	Open pit mine and plant.	Hancock.
General Shale Products Corp.	Johnson City, Tenn. 37601	do	Jefferson.
Harsco Corp., Can-Tex Industries Div.	4th & Washington St. Cannelton, Ind. 47520	2 open pit mines	Hancock.
Kosmos Cement, Division of The Flintkote Co.	Dixie Highway Kosmosdale, Ky. 40272	Open pit mine	Jefferson.
Martin Marietta, Kenlite Div.	129 River Road Louisville, Ky. 40202	Open pit mine and plant.	Bullitt.
Owensboro Brick & Tile Co.	Ewing Road Owensboro, Ky. 42302	do	Hancock.
Coal:			
AMAX Coal Co	105 S. Meridan St. Indianapolis, Ind. 46225	1 strip mine	Muhlenberg.
Beth-Elkhorn Corp	701 E. Third St. Bethlehem, Pa. 18016	3 underground mines.	Letcher and Pike.
Gibraltar Coal Co	150 S. Meridan St. Indianapolis, Ind. 46225	Strip mine	Muhlenberg.
Island Creek Coal Co	Wheelwright, Ky. 41669	5 underground mines.	Floyd.
Do	444 S. Main St. Madisonville, Ky. 42431	3 underground mines.	Hopkins, Muhlenberg, Union.
Do	Holden, W. Va. 25625	3 underground mines.	Pike.
Peabody Coal Co	301 N. Memorial Dr. St. Louis, Mo. 63102	2 underground and 6 strip mines.	Muhlenberg and Ohio.
Pittsburgh and Midway Coal Mining Co.	10 Main Center Kansas City, Mo. 64105	2 underground and 2 strip mines.	Hopkins and Muhlenberg.
U.S. Steel Corp	525 William Penn Place Pittsburgh, Pa. 15230	3 underground and 1 auger mine.	Harlan.
Coke:			
Chemical Coke Co	Dawson Springs, Ky. 42480	Plant	Hopkins.
Hooker Chemical Corp	Box 38 South Shore, Ky. 41175	do	Greenup.
Semet-Solvay Div. of Allied Chemical Corp.	40 Rector St. New York, N.Y. 10006	do	Boyd.
Ferroalloys: Airco Alloys and Carbide.	Box 217 Calvert City, Ky. 42029	do	Marshall.
Fluorspar:			
Calvert City Chemical Co	Box 305 Calvert City, Ky. 42029	Underground mine and mill.	Crittenden and Livingston.
Graphite, artificial:			
Carborundum Co	Hickman, Ky. 42050	Plant	Fulton.
Iron, pig: Armco Steel Corp	Middletown, Ohio 45042	do	Boyd.
Lime: Black River Mining Co	Rt. 1 Butler, Ky. 41006	Limekiln	Pendleton.
Natural gas: Producers:			
Inland Gas Co	340 17th St. Ashland, Ky. 41101	Natural gas wells.	Various.
Kentucky-West Virginia Gas Co.	Second National Bank Bldg. Ashland, Ky. 41101	do	Do.
Wiser Oil	Box 192 Sistersville, W. Va. 26175	do	Do.
Texas Gas Transmission Co	Owensboro, Ky. 42301	do	Do.
Columbia Gas Transmission	Charleston, W. Va. 25325	do	Do.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Perlite, expanded:			
Grefco, Inc	Box 35 Florence, Ky. 41042	Plant	Kenton.
W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 02140	do	Campbell.
Petroleum:			
Producers:			
Ashland Oil and Refining Co.	1409 Winchester Ave. Ashland, Ky. 41101	Crude oil wells	Various.
Har-Ken Oil Co	Box 616 Owensboro, Ky. 42301	do	Do.
Humble Oil & Refining Co.	2010 W. Ohio St. Evansville, Ind. 47712	do	Do.
Sun Oil Co	Box 5026, Lawndale Evansville, Ind. 47715	do	Do.
Refineries:			
Ashland Oil and Refining Co.	1409 Winchester Ave. Ashland, Ky. 41101	Refinery	Boyd.
Kentucky Oil and Refining Co.	Box 325 Betsy Layne, Ky. 41605	do	Floyd.
Louisville Refining Co	1300 S. Western Parkway Louisville, Ky. 40212	do	Jefferson.
Somerset Refinery, Inc.	520 Monticello St. Somerset, Ky. 42501	do	Pulaski.
Sand and gravel:			
Evansville Materials, Inc	624 N.W. Riverside Dr. Evansville, Ind. 47708	Dredge	Henderson.
Ingram Materials, Inc	Box 1049 302 Harding Road Nashville, Tenn.	do	Livingston.
Martin Marietta Aggregates	P.O. Box 120 Mercersburg, Pa. 17236	do	Boone, Jefferson, Oldham.
Nugent Sand Co	Box 6072 Louisville, Ky. 40206	do	Daviess.
Owensboro River Sand and Gravel Co., Inc.	701 East 2d St. Box 1333 Owensboro, Ky. 42301	do	Jefferson.
Stone:			
Limestone, crushed:			
Ken-more Stone, Inc.	Box 482 Georgetown, Ky. 40324	5 quarries and plants.	Carter, Morgan, Rowan.
Kentucky Stone Co., Subsidiary of Koppers Co.	400 Sherburn Lane Louisville, Ky. 40207	5 underground mines, 7 quarries and plants.	Various.
Martin Marietta Corp., Apple Stone Div.	4096 First Ave., N.E. Cedar Rapids, Iowa 52406	5 quarries and plants.	Boone and Jefferson.
Reed Crushed Stone Co., Inc.	Box 35 Gilbertsville, Ky. 42044	1 quarry and plant.	Livingston.
Three Rivers Rock Co	Box 218 Smithland, Ky. 42081	do	Do.
Vulcan Materials Co	Box 7 Knoxville, Tenn. 37901	3 quarries and plants.	Fayette and Jefferson.
Quartzite: Industrial Minerals Co., Inc.	Salem, Ky. 42078	1 quarry and plant.	Livingston.
Vermiculite exfoliated: W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	Plant	Campbell.

The Mineral Industry of Louisiana

By David A. Carleton[1]

For the first time since 1958 mineral production in Louisiana declined, reflecting the generally poor performance in the petroleum sector. The value of mineral output in 1972 was $5,412 million, off 2.5% from the previous year. Crude oil production alone was 4.7% less than that of 1971. Louisiana continued to maintain its second place ranking in domestic mineral production; it was the second largest producer of crude petroleum, natural gas, and natural gas liquids after Texas. These three commodities accounted for 96% of the State's mineral production value.

Although mineral production in Louisiana was down in 1972, economic and industrial activity were on the rise. Capital investments in new projects reached a record $1.9 billion, exceeding the previous record set in 1967 by $1.1 billion. Growth comprised $1.2 billion in nuclear power facilities and $0.7 billion in conventional manufacturing facilities. Investment in expansion projects totaled an additional $756 million. According to the Department of Commerce and Industry, Louisiana ranked among the top States in industrial investment in 1972. Furthermore, with three large nuclear powerplant projects underway, the State has taken the lead in the Nation toward providing necessary nuclear energy supplies.

Other than electric utility projects, the greatest industrial investment was in petroleum refineries and petrochemical plants. Of the $197 million invested in this sector, Olin Corp. invested $28 million in a petrochemical plant in Calcasieu Parish and Shell Chemical Co. invested $24 million in new facilities in St. Charles Parish.

The State's petroleum industry faced many problems in 1972 including lagging production, poor demand caused by a mild winter early in the year, pollution and environmental considerations that affected management decisions to expand existing facilities, and the continued delay in the sale of Federal offshore leases which extended through September 1972. Offshore lease sales which totaled $590 million in September and $1.67 million in December will stimulate industry in southern Louisiana and are expected to result in the discovery of crude oil and natural gas valued in billions of dollars.

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[1] Petroleum specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Mineral production in Louisiana[1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays ......thousand short tons..	1,073	$1,606	1,000	$1,454
Lime ......do....	960	17,625	908	19,614
Natural gas ......million cubic feet..	8,081,907	1,632,545	7,972,678	1,626,426
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels..	54,424	173,425	52,842	167,768
LP gases ......do....	90,271	166,099	98,233	185,660
Petroleum (crude) ......do....	935,243	3,359,710	891,827	3,201,659
Salt ......thousand short tons..	13,352	67,950	13,514	67,464
Sand and gravel ......do....	19,228	24,492	18,920	26,996
Stone[2] ......do....	9,688	14,139	9,190	14,836
Sulfur (Frasch process)..thousand long tons..	[r]3,646	W	3,765	W
Value of items that cannot be disclosed: Cement, gypsum, stone (crushed miscellaneous), and values indicated by symbol W	XX	[r]94,739	XX	99,666
Total	XX	[r]5,552,330	XX	5,411,543
Total 1967 constant dollars	XX	[r]4,721,146	XX	[p]4,501,863

[p] Preliminary. [r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes some crushed miscellaneous stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Louisiana, by parish

(Thousands)

Parish	1971	1972	Minerals produced in 1972 in order of value
Acadia	$117,495	$114,412	Natural gas liquids, natural gas, petroleum.
Allen	7,207	6,480	Petroleum, natural gas, natural gas liquids, sand and gravel.
Ascension	46,369	46,370	Natural gas liquids, petroleum, salt, natural gas.
Assumption	29,847	30,284	Natural gas, petroleum, natural gas liquids.
Avoyelles	5,810	4,112	Petroleum, natural gas, natural gas liquids, sand and gravel.
Beauregard	8,872	7,937	Petroleum, natural gas, sand and gravel, natural gas liquids.
Bienville	W	W	Natural gas, petroleum, sand and gravel, clays.
Bossier	19,701	19,061	Natural gas, petroleum, natural gas liquids, sand and gravel.
Caddo	W	23,628	Petroleum, natural gas, natural gas liquids, sand and gravel, clays.
Calcasieu	63,506	62,587	Petroleum, natural gas, natural gas liquids, lime, salt, sand and gravel.
Caldwell	3,946	3,345	Natural gas, petroleum.
Cameron	312,357	311,335	Natural gas, petroleum, natural gas liquids, salt.
Catahoula	11,309	10,943	Petroleum, sand and gravel, natural gas, stone.
Claiborne	33,527	24,988	Petroleum, natural gas, natural gas liquids, sand and gravel.
Concordia	W	21,521	Petroleum, natural gas, natural gas liquids.
De Soto	9,265	8,332	Petroleum, natural gas, sand and gravel.
East Baton Rouge	21,616	23,786	Lime, cement, petroleum, sand and gravel, natural gas, clays.
East Carroll	24	W	Sand and gravel, natural gas.
East Feliciana	--	W	Sand and gravel.
Evangeline	10,340	10,817	Petroleum, natural gas, natural gas liquids, sand and gravel.
Franklin	2,397	2,219	Petroleum, natural gas.
Grant	2,759	3,779	Petroleum, sand and gravel, natural gas.
Iberia	298,230	311,490	Petroleum, natural gas, salt, natural gas liquids.
Iberville	67,260	61,775	Petroleum, salt, natural gas, natural gas liquids, sand and gravel.
Jackson	1,577	1,203	Natural gas, petroleum, sand and gravel.
Jefferson	357,755	371,150	Petroleum, natural gas, sulfur, natural gas liquids, salt, sand and gravel.
Jefferson Davis	54,077	47,966	Natural gas, petroleum, natural gas liquids, sand and gravel.
Lafayette	19,578	16,337	Do.
Lafourche	470,507	426,523	Petroleum, natural gas, sand and gravel.
La Salle	23,840	23,199	Natural gas liquids, natural gas, petroleum, sand and gravel, clays.
Lincoln	W	19,822	Petroleum, natural gas, sulfur, natural gas liquids.
Livingston	W	W	Sand and gravel.
Madison	1,142	528	Natural gas.
Morehouse	10,011	9,414	Natural gas, petroleum.
Natchitoches	35,200	34,231	Petroleum, natural gas, natural gas liquids, sand and gravel, clays.
Orleans	19,440	21,477	Cement, stone, lime, petroleum, natural gas.
Ouachita	W	7,054	Natural gas, sand and gravel, natural gas liquids, petroleum.
Plaquemines	1,258,074	1,226,430	Petroleum, natural gas, sulfur, natural gas liquids, salt, sand and gravel.
Pointe Coupee	29,427	24,839	Petroleum, natural gas, natural gas liquids, clays.
Rapides	7,804	7,432	Petroleum, sand and gravel, natural gas, clays.
Red River	456	174	Sand and gravel, petroleum.
Richland	22,518	24,597	Petroleum, natural gas liquids, natural gas.
Sabine	1,014	821	Petroleum, sand and gravel, natural gas.
St. Bernard	50,692	55,322	Natural gas liquids, petroleum, natural gas, sand and gravel, clays.
St Charles	85,898	86,672	Petroleum, natural gas, natural gas liquids.
St. Helena	W	W	Sand and gravel, clays.
St. James	11,127	10,582	Petroleum, natural gas, natural gas liquids.
St. John the Baptist	7,755	7,130	Petroleum, natural gas.
St. Landry	42,582	37,324	Natural gas, natural gas liquids, petroleum.
St. Martin	89,672	79,961	Petroleum, natural gas, salt, natural gas liquids, sand and gravel, clays.
St. Mary	536,844	524,946	Petroleum, natural gas, natural gas liquids, salt, stone, lime, sand and gravel.
St. Tammany	8,192	W	Stone, sand and gravel, clays.
Tangipahoa	8,158	W	Sand and gravel, petroleum, clays.
Tensas	4,202	3,646	Petroleum, natural gas, natural gas liquids.
Terrebonne	874,853	852,821	Petroleum, natural gas, natural gas liquids, sulfur, salt.
Union	1,702	842	Natural gas, petroleum, sand and gravel.
Vermilion	312,090	312,724	Natural gas, petroleum, natural gas liquids, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Louisiana, by parish—Continued

(Thousands)

Parish	1971	1972	Minerals produced in 1972 in order of value
Vernon	$507	$507	Sand and gravel.
Washington	1,540	1,943	Do.
Webster	28,817	28,764	Natural gas, natural gas liquids, petroleum, sand and gravel.
West Baton Rouge	W	W	Petroleum, clays, natural gas.
West Carroll	W	W	Natural gas.
West Feliciana	W	W	Sand and gravel.
Winn	3,083	W	Petroleum, gypsum, stone, natural gas.
Undistributed [1]	106,044	86,506	
Total	5,553,009	[2] 5,411,548	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes some petroleum and sand and gravel (1972) that cannot be assigned to specific parishes and values indicated by symbol W.

[2] Data does not add to total shown because of independent rounding.

Table 3.—Indicators of Louisiana business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force thousands	1,399.2	1,460.0	+4.3
Unemployment do	92.8	85.4	−8.0
Employment:			
Contract construction do	77.3	85.1	+10.1
Mining do	50.9	52.8	+3.7
Manufacturing do	174.4	178.8	+2.5
Total all industries do	1,061.4	1,119.7	+5.5
Personal income:			
Total millions	$12,010	$13,126	+9.3
Per capita	$3,252	$3,528	+8.5
Construction activity:			
Total private nonresidential building millions	$141.7	$238.6	+68.4
Highway construction contracts awarded do	$256.1	e $165.0	−35.6
Cement shipments to and within Louisiana thousand short tons	2,239	2,431	+8.6
Farm marketing receipts millions	$745.9	$881.5	+18.2
Mineral production value do	r $5,552.3	$5,411.5	−2.5

e Estimate. p Preliminary. r Revised.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	1,161	365	424	3,391	--	22	6.49	408
Nonmetal	1,190	285	339	2,700	--	87	32.23	1,117
Sand and gravel	1,222	245	299	2,741	1	55	20.43	3,925
Stone	524	348	182	1,624	--	56	34.48	746
Total [1]	4,097	304	1,245	10,456	1	220	21.14	1,566
1972: [2]								
Metal	510	365	187	1,493	--	16	10.72	598
Nonmetal	1,005	282	284	2,264	3	75	34.45	9,228
Sand and gravel	695	226	157	1,501	1	35	23.99	4,556
Stone	375	346	130	1,123	--	27	24.05	493
Total [1]	2,590	293	757	6,380	4	153	24.61	4,572

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

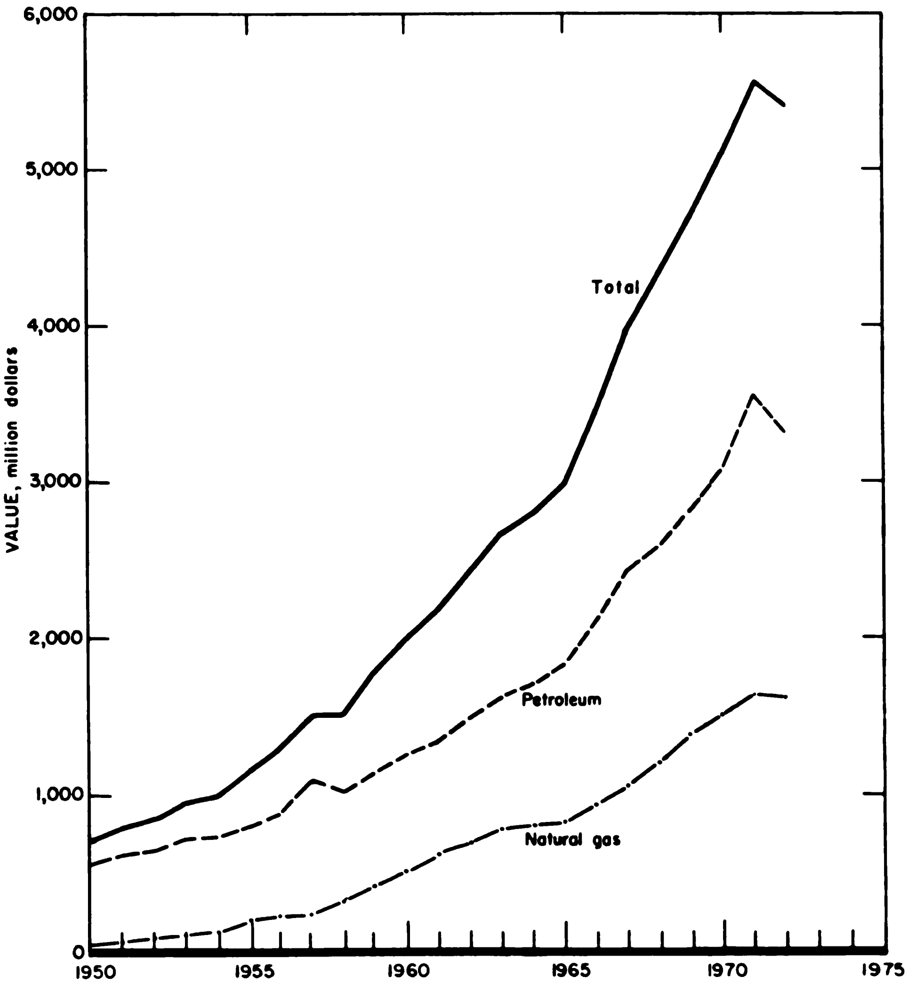

Figure 1.—Value of petroleum, natural gas, and total value of mineral production in Louisiana.

Trends and Developments.—Because of the natural gas shortage, deliveries to industrial plants and electric utility powerplants were curtailed by yearend, as much as 10%. This action caused the closure of some plants. In order to maintain production levels, some companies, particularly chemical process companies, turned to other fuels for a significant share of their process heat requirements. Furthermore, some industries which planned to build facilities in Louisiana in the near future have decided to locate elsewhere because of the natural gas shortage. An example is that of Fibreboard Corp., which had planned to build an industrial insulation plant at Benton but cancelled its plans because it could not obtain a natural gas supply commitment. Gas company officials said that because of natural gas shortages, they were unable to provide gas for such projects even though Fibreboard Corp., would not have been a major user.

It was announced that four new synthetic natural gas plants would be built in Louisiana by 1975, costing about $800 million. One unit, representing a $350 million investment, will be the largest synthetic natural gas plant in the Nation.

Early results of a test using methanol as a fuel proved promising. During a 3-week period 30,000 gallons of a methanol-based methyl fuel was burned at the A. B. Patterson electric utility plant of the New Orleans Public Service Commission. The purpose of the tests was to determine if methanol would be a feasible substitute for natural gas at powerplants.

Considerable development at New Orleans' port was undertaken during the year. The Port of New Orleans authority doubled its annual storage-handling capacity by the installation of a bulk material stacking and reclaming system at a cost of $1.5 million.

A task force was appointed by the State to investigate all facets of an offshore superport facility and to develop a long-range coastal zone management program by 1975. Protection of the delicate marshland was a mandatory obligation. Oil industry representatives informed the task force that an offshore facility was needed by 1976 or 1977; however, the U.S. Army Corps of Engineers is not planning a final report on site selection until early 1974. Two different oil company groups are planning deepwater terminal facilities, one off the Texas coast and the other off Louisiana. The Louisiana project would be a monobuoy, similar to those used in the Persian Gulf. The site had not been determined, but an area off Grand Isle was being considered. Although the plans were attacked by environmentalists who claimed the facility would cause widespread ecological damage to the marsh coastline, superport planners countered that they were genuinely concerned for preserving Louisiana's unique coastline and numerous marshy bays. A U.S. Maritime Administration report in November favored Louisiana and Delaware as sites for superport terminals. The report stated that ports are needed to help stave off an energy crisis and recommended a site 4 miles west of South Pass as the most economically feasible place for a gulf coast superport.

Legislation and Government Programs.—In a special session made necessary by a court order to revise State property tax laws, the State legislature raised the State's severance tax by $0.01 per 1,000 cubic feet of natural gas produced to $0.033 per 1,000 cubic feet. The revised levy will yield the State an estimated $46 million per year. Exempted from the higher tax are (1) producers that have contracts which do not have pass-along clauses permitting producers to recover the tax increase from consumers, (2) production from small, marginal wells, and (3) electric utilities. Opponents to the new tax believe efforts to attract new industry to Louisiana may suffer from the increase. Factors influencing this position are the recent appeal of the state's natural gas severance tax credit for industries and the lower natural gas prices available to out-of-State users because of Federal regulation of interstate sales.

The State Government collected more taxes in fiscal 1972 than in any previous year, although the general severance tax receipts decreased $12.0 million. Severance taxes were collected on the production of natural resources taken from the soil or water. Severance taxes from mineral extraction amounted to $240.4 million during fiscal 1972 and accounted for 23% of the State Government's total revenue.

The Governor's Natural Gas Negotiating Committee, established in 1971, submitted a report urging that a permanent commission be established and charged with the continuing responsibility for the study of natural gas and energy problems in the State. The committee felt that certain basic data should be gathered and analyzed so that legislative programs could be promulgated. The data would include—

1. Study of pipeline systems in Louisiana including capacity, current load, and life.
2. Estimated reserves available and an indication of market commitments.
3. Study of potential future gas reserves.
4. Study of pricing mechanisms and marketing system differences for interstate and intrastate markets.
5. Study of the economic and ecological impact of the curtailment of natural gas consumption in Louisiana.
6. The projected demand in Louisiana for natural gas and the additional delivery and distribution systems that may be required.

On May 1, the U.S. Geological Survey took over the administration and supervision of offshore oil and gas operations in Zone II and III from the Louisiana Conservation Commission. Leases in Zone I and those transected by the boundary between Zone I and II remain under State authority. Zone IV was placed under Federal control in December 1970. It is estimated offshore Louisiana areas under Federal administration will account for 45% of the State's crude oil production and 35% of the natural gas.

The Supreme Court decreed in October that a portion of offshore acreage in dispute between Louisiana and the Federal Government belongs to Louisiana. It was estimated that the area involved was about 85 square miles located within the 3-mile limit near the Texas border. The decree allowed Louisiana to lease the area for drilling and mineral exploration, resulting in revenues reaching $100 million. Still in dispute was ownership of other offshore areas which have yielded $100 to $800 million in income from oil and gas wells. A court-appointed arbitrator is in charge of the dispute.

The long-standing dispute between Texas and Louisiana over ownership of the western half of the Sabine River continued during 1972. Although a special judge appointed by the Federal courts recommended to the U.S. Supreme Court that the boundary be in the geographic center of the river, Louisiana's Attorney General announced that Louisiana would be vigorously opposed to such a decision.

Steps were taken during May to enable the State of Louisiana to become a natural gas marketer. Until 1971 Louisiana did not include in oil and gas leases on State lands the clause permitting the government to take its royalty interest in kind rather than cash. New State leases issued in 1972 have this provision, which has long been the practice in private leases. By taking its one-sixth royalty in gas instead of cash at the area rate prices established by the Federal Power Commission, Louisiana will have gas to offer prospective industrial developers within the State.

Environment.—A study of the effects of an oil spill on marsh lands and in shallow bays was started in November at Louisiana State University. The thrust of the study will be to develop evidence that marine organisms consume the crude oil that settles at the bottom of shallow water following accidental spills. The study, which should take at least 1 year, is funded by the Environmental Protection Agency (EPA) and the Louisiana State University and is supported logistically by Gulf Oil Corp.

The Louisiana Air Control Commission approved a new clean air plan incorporating changes demanded by the EPA. Parts of the previous plan were rejected by EPA for being too lenient. The large petrochemical industry in Louisiana will feel the greatest impact of the plan. It has been estimated that the program will cost the industry $250 million during the next 5 years. The plan envisages a 61% reduction in sulfur dioxide emissions in Baton Rouge, 37% in New Orleans, and 12% in Lake Charles, the areas of greatest air pollution. The plan allows the State to close virtually all businesses and industry in times of emergency.

The Louisiana Chemical Association announced that chemical industries in the State plan to spend more than $290 million during the next 5 years for pollution control systems. Expenditures during 1967–71 to control water pollution totaled $87 million, while $58 million was spent in air pollution control facilities. A report released by the EPA in early 1972 stated that industries were dumping tons of toxic materials into the Mississippi River. Another EPA study reported excessive levels of particulates throughout the State and dangerous levels of sulfur dioxide and hydrocarbons in heavily industrialized areas.

The Federal District Court at New Orleans approved an agreement between EPA and Kaiser Aluminum & Chemical Co. that will halt the discharge of spent bauxite from its two alumina plants into the Mississippi River.

A new multi-million-dollar wastewater treatment system designed to clean 8,000 gallons per minute was completed and put into operation at the Baton Rouge plant of Enjay Chemical Co. The treatment plant is a major part of a large project designed to improve the quality of water that flows from the plant into the Mississippi River. The new plant employs a trickling filter system and is one of many facilities used for treating water at the plant. BASF Wyandotte Corp. released plans to eliminate all lead and mercury discharges from its chlorine-caustic soda production units in Geismar. The replacement of graphite anodes with metal anodes was slated for completion in 1973.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The value of mineral fuel production totaled $5,182 million in 1972, a 2.8% decrease from that of 1971. Fuels represented 96% of the entire value of mineral production in Louisiana.

Leasing Activity.[3]—Because leasing, exploration, and development of liquid and gaseous hydrocarbons cannot always be classified as either a petroleum or natural gas activity these topics are discussed under this general heading.

Although State lease sales continued on a monthly basis in 1972, leasing activity in southern Louisiana, both onshore and offshore to the limits of State jurisdiction, declined. Onshore activity declined 16% from 1971, with a total of 850,231 acres leased.

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[3] American Association of Petroleum Geologists Bulletin. V. 57, No. 8, Aug. 1973, pp. 1532–1541.

Table 5.—Oil and gas well drilling completions, by parish

Parish	Development wells			Exploratory			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Acadia	12	7	14	--	3	9	45	442,977
Allen	--	--	5	--	1	8	14	126,809
Ascension	--	1	2	--	--	3	6	52,857
Assumption	2	6	4	--	4	6	22	275,736
Avoyelles	--	--	1	1	--	1	3	29,006
Beauregard	2	2	7	1	1	6	19	182,471
Bienville	1	30	4	--	2	3	40	359,571
Bossier	25	13	17	--	1	3	59	153,993
Caddo	142	2	25	--	--	4	173	374,589
Calcasieu	31	3	20	1	1	11	67	483,990
Caldwell	--	5	22	--	4	21	52	162,464
Cameron	11	7	23	1	7	29	78	834,173
Catahoula	6	--	16	4	--	26	52	283,649
Claiborne	5	3	2	--	--	4	14	139,180
Concordia	9	--	25	3	--	27	64	414,712
De Soto	3	15	17	--	2	1	38	168,098
East Baton Rouge	--	--	1	--	--	--	1	9,815
East Carroll	--	--	--	--	--	2	2	18,765
East Feliciana	--	--	--	--	--	1	1	18,813
Evangeline	2	6	5	--	1	4	18	217,245
Franklin	2	--	2	--	--	2	6	26,783
Grant	3	--	2	--	--	1	6	15,763
Iberia	13	7	14	1	1	13	49	490,451
Iberville	20	2	9	4	1	11	47	456,281
Jackson	--	--	--	--	--	5	5	39,829
Jefferson	25	5	8	--	1	9	48	494,935
Jefferson Davis	4	6	5	1	1	15	32	338,829
Lafayette	--	2	2	--	2	4	10	138,163
Lafourche	23	15	21	1	5	11	76	848,295
La Salle	55	4	32	--	--	10	101	307,171
Lincoln	--	3	3	--	--	5	11	84,434
Morehouse	--	76	8	--	--	2	86	203,948
Natchitoches	--	--	2	--	--	4	6	25,561
Orleans	--	--	--	--	--	2	2	19,656
Ouachita	--	183	3	--	1	2	189	469,321
Plaquemines	49	4	20	--	--	18	91	857,198
Pointe Coupee	3	--	1	1	--	1	6	62,220
Rapides	2	--	3	--	--	--	5	32,651
Red River	10	--	5	--	1	3	19	56,956
Richland	--	--	10	--	--	5	15	49,796
Sabine	--	--	6	--	1	1	8	28,863
St. Bernard	--	--	3	--	1	13	17	168,328
St. Charles	19	10	6	--	--	6	41	446,470
St. James	3	--	1	--	--	3	7	72,184
St. John the Baptist	--	1	3	--	--	2	6	53,079
St. Landry	7	6	14	--	--	8	35	324,285
St. Martin	22	10	12	1	2	12	59	590,799
St. Mary	50	14	15	1	4	15	99	1,065,296
St. Tammany	--	--	--	--	--	1	1	10,800
Tensas	2	--	4	1	--	5	12	84,161
Terrebonne	55	44	31	1	18	32	181	2,139,124
Union	--	98	--	--	--	5	103	262,276
Vermilion	5	16	8	1	8	18	56	772,989
Vernon	--	--	--	--	--	3	3	34,060
Webster	3	7	3	--	--	1	14	120,633
West Baton Rouge	1	--	3	--	--	2	6	55,992
Winn	17	--	11	--	--	13	41	66,985
Offshore	251	126	215	--	5	201	798	7,948,180
Total	895	739	695	24	79	633	3,065	24,011,608

Source: American Petroleum Institute.

Over 30% of these onshore leases were in the Cretaceous trend from St. Bernard Parish in the east to Allen Parish in the west. Principal leasees were Chevron Oil Co., Union Oil Co. of California, Phillips Petroleum Co., Gulf Oil Corp., and Standard Oil Co. (Indiana). To the south in the onshore Miocene trend, 20% of the leasing was in Terrebonne Parish. Major leases there were granted to Shell Oil Co., Texas Eastern Transmission Corp., Texas Gas Transmission Corp., and Standard Oil Co. (Indiana). To the southwest in Cameron Parish companies showed interest in the Planulina formation of the Miocene trend. Small companies leased acreage in Acadia and St. Martin Parishes. Onshore lease prices ranged from $2 per year per acre for 10-year leases in the Cretaceous trend to $100 per year per acre for a 3-year lease in the Oligocene and Miocene trends.

At yearend it was anticipated that monthly sales would be discontinued until a means could be formulated whereby gas produced on State acreage could be retained in the State to prevent industries from being closed because natural gas supplies have to be shipped out of the State.

Offshore, the Federal Eastern Louisiana lease sale was held in September after months of delay. The sale was originally slated for December 1971, but was delayed by environmentalists who contended that the Department of the Interior failed to consider alternative sources of energy in its environmental impact statement. Of the 78 tracts offered for bidding at the sale, 74 were bid on and 62 were leased. High bonus bids from these 62 tracts, totaling 290,521 acres, amounted to $1.6 billion, an average of $2,016 per acre. The highest bid was made by a consortium of Gulf Oil Corp., Mobil Oil Corp., Pennzoil Offshore Gas Operators, Inc. (POGO), and Pennzoil Louisiana and Texas Offshore, Inc. (PLATO) which bid over $77 million ($15,494 per acre) for Main Pass Block 140. This Block was the most sought after tract, receiving 15 bids totaling nearly $246 million. The highest per-acre bid in the sale was $21,070 paid by Gulf Oil Corp. and Standard Oil Co. (Indiana) for a drainage tract (one near a producing field) consisting of 1,893 acres in West Delta 35 and 36.

On December 19, 1972, a second Federal lease sale offered 132 tracts in the Louisiana Outer Continental Shelf. Bids were received on 119 tracts and 116 were leased. The leased tracts covered 536,874 acres and bids amounted to nearly $1.7 billion, an average of $3,108 per acre. The highest per-acre bid, $21,630, was paid by a consortium of seven companies headed by TransOcean Oil, Inc., on each of two tracts in South Marsh Island sector.

Leasing in northern Louisiana continued to be active, with the Jurassic area to the far north receiving the most attention. Lease bonuses ranged from $5 to $50 per acre per year and averaged $25.

Geophysical Activity.[3]—Geophysical exploration in Louisiana consisted of 1,094 crew-weeks onshore and 241 crew-weeks offshore. In total, geophysical activity was up slightly from the 1,314 crew-weeks in 1971. Onshore Terrebonne and Lafourche Parishes received considerable seismic exploration activity because of recent significant gas discoveries and extensions in the Miocene, and large potentially prospective undrilled areas. Shell Oil Co. and Standard Oil Co. (Indiana) accounted for 75% of the total. Additional seismic exploration was performed in Cameron and Vermilion Parishes in pursuit of deep, large, lower Miocene traps and other smaller closures near prolific fields.

Most of the offshore geophysical activity was in those areas leased in the Federal sale held in December 1972. Areas in the September 1972 sale had been surveyed in 1971. As in the past, subsurface structural geologic studies, using electric log and reflection seismic data, remained the basic exploratory methods in the Louisiana gulf coast. As stratigraphic traps became more prospective, many companies are reprocessing old seismic data and conducting new work over known large structures looking for sandstone pinch-outs.

Whereas geophysical activity in the south, including offshore areas, decreased 9% to 955 crew-weeks, seismic activity in northern Lousiana increased a substantial 40% to 370 crew-weeks. A total of 72 crew-weeks were in vibroseis. Most of the activity was in Winn (82 crew-weeks), Natchitoches (66), Madison (56), and Union (34) Parishes.

Exploration and Development Drilling.[4]—According to the American Petroleum Institute (API) there were 3,065 wells drilled in Louisiana, including all offshore areas in 1972. Footage drilled was 24.0 million feet, an average of 7,834 feet per well, somewhat under the 8,056-foot average in 1971. Onshore drilling accounted for 2,267 wells and 16.0 million feet of hole. Offshore drilling accounted for 798 wells and 8.0 million feet of hole, an average depth of 10,046 feet per well.

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[3] Work cited in footnote 2.
[4] Work cited in figure 2.

Exploratory drilling accounted for a total of 736 wells—530 onshore and 206 offshore. Whereas onshore exploratory drilling changed little from that of 1971, offshore drilling declined 23% reflecting the postponement of the Federal lease sale. Of the exploratory onshore wells, 24 were completed to produce oil, 74 were completed as gas producers, and 432 wells or 81% were dry. Of the offshore exploratory wells, none were completed as oil wells, 4 were gas productive, and 201 wells or 98% were dry. Proved field (development) well drilling accounted for 2,329 wells, of which 1,737 or 75% were onshore. Of the onshore proved field wells 644 were oil productive, 613 were gas productive, and 480 or 28% were dry holes. Of the 592 proved field wells drilled offshore, 251 were completed to produce oil, 126 were gas productive, and 215 or 36% were dry holes.

In north Louisiana, which covers 26 parishes, a total of 1,125 wells were drilled, 13% more than the 992 wells drilled in 1971. Exploration drilling totaled 175 wells, unchanged from 1971. Of this total, 20 (11.4%) were completed successfully. None of the discoveries added appreciably to reserves; seven were in the Wilcox formation of the Eocene series. Development drilling totaled 950 including 9 service wells. Of this total 234 wells found oil and 488 found gas for a success ratio of 76%. Much of the development drilling activity was in the Monroe field which lies in parts of Morehouse, Ouachita, and Union Parishes. Development drilling was also active in Caddo and La Salle Parishes.

Onshore in the remaining 39 counties in southern Louisiana, a total of 1,144 wells were drilled, essentially unchanged from the 1,142 wells drilled in 1971. The 790 development wells included 355 oil producers, 161 gas wells, 15 oil and gas producers, and 259 dry holes (success ratio of 67%). Of the 354 exploration wells, 78 were oil and gas producers, and 276 were dry wells (success ratio of 22%).

Important new-field discoveries onshore in southern Louisiana included a find called Bayou Queue De Tortue in Lafayette Parish. Production depth was 15,336 feet in an Oligocene formation which yielded a 48° API gravity crude at 432 barrels per day and natural gas at 5.8 million cubic feet per day. A second important find called Northwest Bayou Choctaw located in Iberville Parish produced 132 barrels per day of 45° API gravity crude oil and 0.4 million cubic feet of natural gas from 11,524 feet. A third discovery found 78 barrels per day of 44° API gravity crude oil and 5.4 million cubic feet per day of natural gas at 15,688 feet in Lafayette Parish. Other major finds were recorded in Cameron, Lafourche, St. Mary, and Terrebonne Parishes.

Offshore, 798 wells were drilled having a total footage of 8.0 million. Of that total, 592 were development (proved field) wells and 206 were exploratory. None of the exploratory wells were classified as oil discoveries and only five found natural gas. Of the offshore proved field drilling, 251 wells found oil, 126 found gas, and 215 were dry. Although none of the offshore exploration wells were classified as discoveries, nine wells were listed as having the potential to produce gas and four were potential oil well producers. Most of the important offshore, new-field discoveries were in the East Cameron and Vermilion sections. Of the nine offshore development wells classified as important, four were gas wells in the East Cameron sector and two were oil wells in the Eugene Island sector.

The major finds in Louisiana during the year were new-pool discoveries in known fields. The most important of these was brought in by Pennzoil Oil Co. in Terrebonne Parish. The well on initial test produced 308 barrels per day of 49.9° API gravity crude oil and 10.6 million cubic feet of natural gas from a depth of 14,980 feet.

Carbon Black.—The production of carbon black in 1972 amounted to 1,078 million pounds, essentially unchanged from the 1,079 million pounds produced in 1971. Louisiana continued to rank second after Texas, accounting for 33.7% of the country's total. Essentially all of the output was furnace black; only insignificant quantities of channel black are produced.

As the Nation's leading producer of carbon black from natural gas, Louisiana consumed 236 billion cubic feet of natural gas and 178 million gallons of liquid hydrocarbons. The total value of production was $78.8 million for an average value of $0.073 per pound.

At yearend, the State's nine plants had a

Tabe 6.—Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Proved reserves Dec. 31, 1971	Changes in proved reserves due to net revisions, extensions, and discoveries in 1972	Proved reserves Dec. 31, 1972 (production deducted)	Changes from 1971 (percent)
Crude oil ______thousand barrels__	5,399,000	409,364	5,028,478	—7.4
Natural gas liquids ________do____	2,467,880	—180,943	2,135,337	—15.5
Natural gas ____million cubic feet__	78,625,854	4,758,592	74,971,334	—4.9

Source: American Petroleum Institute and American Gas Association.

capacity of 3,870,108 pounds per day, 33.9% of the country's total. Most of the production came from the three plants in St. Mary Parish. Other plants are located in Ouachita (two plants), Avoyelles, Calcasieu, Evangeline, and West Baton Rouge.

Table 7.—Carbon black production and value

(Million pounds and million dollars)

Year	Quantity	Value
1968 ___________________	1,031	70.4
1969 ___________________	1,046	70.8
1970 ___________________	982	70.6
1971 ___________________	1,079	78.2
1972 ___________________	1,078	78.8

Natural Gas.—Louisiana continued to rank second in the Nation in marketed natural gas production; however, for the first time since 1947 production declined. Marketed output dropped 1.4% in 1972 to 7,973 billion cubic feet. Although production declined, average wellhead values increased from $0.202 to $0.204 per thousand cubic feet. The State continued to lead the Nation in the total value of marketed production in spite of a slight decline.

Sea Robin Pipeline Co. embarked on a $59 million expansion program that will include a 10,500-horsepower compressor station 80 miles offshore which is believed to be the most distant from shore for its size. The 1972–73 construction program includes an onshore compressor station at Erath and 71 miles of new pipeline to connect with gas production in the Eugene Island, East Cameron, and Ship Shoal areas. The system's capacity will be increased from 829 million to 1.2 billion cubic feet per day. Completed in 1970, the original system consisted of 222 miles and cost $86 million.

Table 8.—Natural gas data

(Million cubic feet)

Year	Withdrawals [1]			Disposition			
	From gas wells	From oil wells	Total	Marketed production [2]	Value at wells (thousands)	Repressuring	Vented and Wasted [3]
1968 _______	5,623,961	1,153,555	6,777,516	6,416,015	$1,212,627	195,062	166,439
1969 _______	6,305,897	1,255,130	7,561,027	7,227,826	1,387,743	174,349	158,852
1970 _______	6,811,334	1,264,823	8,076,157	7,788,276	1,503,137	133,792	154,089
1971 _______	7,011,666	1,306,885	8,318,551	8,081,907	1,632,545	133,080	103,564
1972 _______	6,924,204	1,235,559	8,159,763	7,972,689	1,626,426	123,418	63,667

[1] Marketed production plus quantities used in repressuring, vented, and wasted.

[2] Comprises gas sold or consumed by producers including losses in transmission, amounts added to storage, and increases in pipelines.

[3] Partly estimated. Includes direct waste on producing properties and residue blown to the air.

Texaco Inc., will be the operator of a cryogenic gas processing plant to be constructed at Henry, south of Layfayette. Twenty other companies are involved in the project. Offshore Louisiana natural gas from the Sea Robin pipeline system will supply the new 900-million-cubic-foot-per-day plant where natural gas will be treated at temperatures down to 140° F. Texaco's nearby Henry plant will separate the individual liquid, whereas the methane will be returned to the onshore Sea Robin system. Completion is scheduled for mid-1973.

A subsidiary of Texas Eastern Transmission Corp. announced plans to build a $175 million synthetic natural gas (SNG) plant on a 3,500-acre site near Donaldsonville. The plant will make 500 million cubic feet of gas from 110,000 barrels per day of lightweight petroleum products. One-third of the feedstock will be supplied from domestic sources and two-thirds will be imported. The gas will be delivered by pipeline to northeastern States.[5]

Several companies in the country, including the New Orleans Public Service Commission, studied the possibility of using methanol as a substitute fuel for natural gas. It was tentatively planned to conduct tests at one of the Commission's generators using methanol from the Georgia-Pacific Corp. plant near Plaquemine. This latter plant, which was completed in late 1971 at a cost of $44 million, produces 100 million gallons per year using a low-pressure process. The plant also produces phenol and acetone.

At yearend, the Mississippi River Transportation Corp. planned to establish another gas storage unit in the eastern portion of Unionville field in Lincoln Parish. The new unit will utilize a depleted sand formation for storage of gas to be used for peak shaving purposes to meet high winter demand.

At midyear Pennzoil Offshore Transmission Co., a new corporation, announced plans to construct a $126 million natural gas pipeline originating 110 miles offshore in Louisiana's western continental shelf. The 30/36 inch line will terminate some 270 miles to the north in west-central Louisiana. Plans are to deliver 400 million cubic feet per day at a point near Clarence and in the future to increase the capacity to 800 million cubic feet per day.

According to the American Gas Association (AGA) and API, reserves of natural gas totaled 74,971 billion cubic feet, down 4.7% from the previous year. Although there were additions to reserves by reasons of revisions, extensions, and new reservoir discoveries in old fields, additions resulting from new field discoveries were only 293 billion cubic feet. About 82% of the reserves were classified as nonassociated; most of these are presumably offshore.

Natural Gas Liquids.—Louisiana continued to rank second after Texas in natural gas liquids production, which in 1972 amounted to 151.1 million barrels, a 4% increase from 1971. Of this amount, output of liquefied petroleum gases (including ethane) increased 8.8% to 98.2 million barrels while natural gasoline and cycle products declined 2.9% to 52.8 million barrels. Average value per barrel of the liquefied petroleum gas (including ethane) and natural gas and cycle products production was $1.89 and $3.17, respectively.

According to an Oil and Gas Journal Survey[6] there were 132 natural gas processing plants in Louisiana at yearend 1972 with a total capacity of 23,512.4 million cubic feet per day. Natural gas throughput at these plants totaled 19,547.1 million cubic feet representing a plant capacity utilization of 83%. Thus utilization was down from 86% in 1971, reflecting the natural gas shortage.

Of the 51 major natural gas processing plants (those having a capacity of 70 million cubic feet per day or more), 40 plants used the refrigerated absorption method, some in conjunction with other methods. Most of the remainder employed the adsorption method.

The AGA and API estimated that natural gas liquids reserves at yearend 1972 totaled 2,136 billion barrels. This was 15.5% less than 1971 and represents the fourth consecutive year of decline. Nearly 84% of these reserves were in nonassociated gasfields. Louisiana accounted for 31.5% of the Nation's total natural gas liquids reserves.

Columbia Gas Transmission Corp. completed its natural gas processing plant at Pecan Island. The plant has a capacity of 900 million cubic feet per day and 18,000 barrels per day of condensate and is among the largest along the U.S. Gulf Coast. The plant processes gas brought ashore through the Western Shore line and the Blue Water system. The 250-mile Blue Water system serves four offshore Louisiana areas.

Warren Petroleum Co. began production at its new gas-treating plant at Johnson Bayou in Cameron Parish. The unit's capacity is 60 million cubic feet of natural gas input and 65,000 gallons per day of liquid extracts.

Petroleum.—For the first time since 1958 crude oil production in Louisiana declined. Output of 891.8 million barrels (2,436,685 barrels per day) in 1972 represented a 4.6% decline from that in 1971. Nationwide, Louisiana ranked second in crude oil production and accounted for 25.8% of the U.S. total.

In September, the Commissioner for Conservation announced that nearly all wells in Louisiana were producing at their maximum efficient rate (MER) and for all practical purposes, Louisiana no longer possessed a reserve producing capacity. At yearend nominations for crude oil exceeded production by about 150,000 barrels per day and production was declining each month at a rate of 20,000 barrels per day.

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[5] Chemical Week. V. 8, No. 19, Nov. 8, 1972, p. 33.

[6] Oil and Gas Journal. 1973 Survey of Gas Processing Plants. V. 71, No. 28, July 9, 1973, pp. 98–114.

Table 9.—Crude oil production, indicated demand and stocks in 1972, by month

(Thousand 42-gallon barrels)

Month	Production	Indicated demand	End of month stocks originating within State
January	76,022	76,779	32,271
February	70,297	69,919	32,649
March	76,219	77,078	31,790
April	73,515	70,827	34,478
May	77,131	76,520	35,089
June	73,381	75,221	33,249
July	75,389	76,927	31,711
August	75,435	75,213	31,933
September	73,000	72,270	32,663
October	75,331	75,502	32,492
November	72,362	72,959	31,895
December	73,745	75,209	30,431
Total:			
1972	891,827	894,424	XX
1971	935,243	940,725	XX

XX Not applicable.

Table 10.—Number of producing oil wells and average production per well per day

Year	Approximate number of producing wells Dec. 31	Average production per well per day[1] (barrels)
1968	30,226	[r]73.0
1969	29,393	[r]77.6
1970	[r]27,934	[r]86.7
1971	[r]26,829	[r]93.6
1972	[e]27,762	89.3

[e] Estimated. [r] Revised.

[1] Based on the average number of wells during the year.

Table 11.—Production of crude petroleum, by district and selected fields

(Thousand 42-gallon barrels)

District and field[1]	1971	1972
Gulf coast onshore:[2]		
Avery Island	3,400	3,880
Bay de Chene	6,643	6,551
Bay Ste. Elaine	7,775	7,247
Bayou Salle	5,293	3,697
Black Bay West	9,892	9,113
Caillou Island	31,828	29,683
Cote Blanche Bay West	15,658	13,908
Cote Blanche Island	8,797	8,015
Delta Farms	1,278	1,281
Garden Island Bay	16,096	12,993
Golden Meadow	2,738	2,306
Grand Bay	6,680	6,661
Hackberry East	2,226	1,995
Hackberry West	3,760	3,349
Iowa	876	852
Jennings	292	256
Lafitte	10,877	9,333
Lake Barre	7,592	6,625
Lake Pelto	4,891	4,502
Lake Salvador	4,380	4,118
Lake Washington	10,913	9,333
Leeville	4,343	4,246
Paradis	1,898	1,720
Quarantine Bay	7,117	4,538
Romere Pass	3,759	3,074
Venice	5,475	5,380
Vinton	2,299	2,782
Weeks Island	10,183	11,053
West Bay	9,563	9,040
Other fields	267,999	214,108
Total	474,521	401,639
Gulf coast offshore:[2]		
Bay Marchand Block 2	30,806	29,390
Eugene Island Block 126	5,621	5,527
Eugene Island Block 175	(3)	6,954
Eugene Island Block 276	(3)	7,613
Grand Isle Block 16	21,681	19,690
Grand Isle Block 43	22,776	23,095
Grand Isle Block 47	4,271	4,172
Main Pass Block 35	3,504	3,148
Main Pass Block 41	18,469	17,678
Maine Pass Block 69	12,775	11,566
Main Pass Block 306	(3)	7,576
Ship Shoal Block 204	(3)	5,300
Ship Shoal Block 207	(3)	8,638
Ship Shoal Block 208	10,038	14,420
South Marsh Island Block 73	(3)	5,453
South Pass Block 24	20,330	18,227
South Pass Block 27	21,425	17,312
South Pass Block 62	(3)	10,248
South Pass Block 65	(3)	11,931
West Delta Block 30	26,390	25,144
West Delta Block 58	(3)	8,674
West Delta Block 73	15,987	16,250
Other fields	201,232	167,909
Total[4]	415,305	445,915
Northern:		
Caddo-Pine Island	3,500	3,448
Delhi	5,870	5,848
Haynesville	2,730	2,196
Homer	330	(3)
Lake St. John	1,170	(3)
Rodessa	900	552
Other fields	30,916	32,229
Total	45,416	44,273
Grand total[4]	935,243	891,827

[1] Breakdown for individual fields from the Oil and Gas Journal.

[2] Some fields include onshore and offshore production.

[3] Included in "Other fields."

[4] Data may not add to totals shown because of independent rounding.

According to the API, reserves of crude oil at yearend totaled 5,028 million barrels, down 371 million barrels from that of 1971. Additions to reserves resulting from reevaluation of known reservoirs, extensions of known fields, and discovery of new fields and reservoirs amounted to only 409 million barrels.

According to a Bureau of Mines survey, there were 20 refineries operating in Louisiana which had a crude oil throughput capacity of 1,553,500 barrels per day at yearend 1972. The only new refinery added was the small, 11,000-barrel-per-day unit owned by Kerr-McGee Corp. at Dubach. Major expansion projects included throughout capacity additions of 36,000 barrels per day at the Meraux refinery of Murphy Oil Corp., 19,600 barrels per day at the Alliance plant of Gulf Oil Corp., and 15,000 barrels per day at the Lake Charles refinery of Cities Service Oil Co. Because of retirement of older units at the Baton Rouge plant of Exxon Co., U.S.A., capacity of the Nation's largest refinery fell to 420,000 barrels per day.

A study by the Oil and Gas Journal in early 1972 placed the spare production capacity at 200,000 barrels per day from onshore fields and State-controlled offshore fields. The study found that only 35 of the State's 1,389 oilfields were capable of producing significant volumes over the State-controlled output.

In January the Conservation Commissioner set the February allowable pattern at 75% of the 1971 depth bracket schedule, up from 69% in January. This was the highest percentage in the history of the program except at the time of the 1956 Suez Canal crisis and the 1967 Arab-Israeli war. Allowables remained unchanged until September when producers were permitted to produce at the maximum efficient rate (MER); in October regular monthly allowable hearings were discontinued because the State could not produce all the oil requested by buyers. Wells in Federal offshore waters had been producing at the MER since 1971.

Petrochemicals.—The petrochemical industry in Louisiana continued to expand as many new plants were brought onstream while others were expanded. Furthermore, plans for additional petrochemical facilities were abundant. For the first time, however, selected Louisiana industrialists pondered the uncertain future of their feedstocks, especially ethylene, benzene, and naphtha. This apprehension was brought about by the predicted energy crisis, a switch to nonleaded gasoline, and the uncertainty of imported feedstocks.

The tight chlorine supply situation expected since early 1972 spurred the expansion of existing plants and the construction of new plants. Hooker Chemical Corp. plans to build a chlor-alkali plant at Taft to increase its current 650-ton-per-day capacity. The new plant will be able to produce 1,000 tons per day of chlorine and 1,100 tons per year of caustic soda. Completion is scheduled for late 1974. Other chlorine expansion projects have been announced by Georgia-Pacific Corp. at Plaquemine, BASF Wyandotte Corp. at Geisman, and PPG Industries at Lake Charles. Dow Chemical Co. announced plans to expand chloromethane production at Plaquemine, bringing the plant's total capacity to 250 million pounds per year.

Gulf Oil Corp.'s first venture into styrene monomer commenced in January when its large 500-million-pound-per-year unit went onstream in Donaldsonville at a cost of $16.4 million. The product will be used in the manufacture of tires, insulation, boat hulls, and molded auto parts.

American Cyanamid Co. announced plans to build a new acrylamide plant at its Fortier complex in New Orleans, using its newly developed catalytic process. Brewster Phosphates, Inc., is building a facility at Luling just west of New Orleans to produce diammonium phosphate. When completed the firm will be able to produce 350,000 tons per year of this product. Shell Chemical Co. announced plans to build a vinyl chloride monomers unit at Norco to have a capacity of 1,000 tons per day and to be completed in 1973.

Agrico Chemical Co., a subsidiary of Williams Co., began a $50 million expansion program at Donaldsonville which includes a 400,000-ton-per-year phosphoric acid plant to be completed in mid-1974.

After bringing a new polypropylene unit onstream at Lake Charles during the spring with a capacity of 180 million pounds per year, Hercules, Inc. plans another new plant on the gulf coast to have a capacity of 200 million pounds per year.

CF Industries, Inc. announced that it plans to build a 1,000-ton-per-day urea plant at Donaldsonville for completion by mid-1974.

Shell Chemical Co. disclosed its decision to build a 700-million-pound-per-year vinyl chloride monomer (VCM) plant at the company's chemical complex at Norco. When the plant comes onstream in late 1973, the company will be the country's largest producer of VCM.

Olin Corp. contracted for the engineering and construction of a $3 million plant at Lake Charles to convert natural gas into hydrogen and carbon monoxide using steam-methane reforming furnaces. Installation was slated for early 1973.

Construction of Enjay Chemical Co.'s $90 million olefin expansion project at Baton Rouge continued during 1972. The plant was designed to use a wide range of feedstocks that require about 94,000 barrels per day of distillate fuel oil; the remainder will be ethane and propane. Ethylene output at the plant will be increased from 1 billion to 1.8 billion pounds per year, chemical-grade butadiene production will be raised from 180 to 340 million pounds per year, and propylene will be increased from 50 to 130 million gallons per year.

NONMETALS

Value of nonmetals increased by $9 million in 1972 to $230 million and comprised 4% of the State's total mineral value. The increase came after 3 consecutive years of decrease and reflects primarily the increase in the unit value of sand and gravel. Of the eight nonmetallic minerals produced, the value of production of six increased while two decreased.

Barite.—Crude barite is not mined in Louisiana. However, one plant in Calcasieu Parish, three in Orleans Parish, and one in St. Martin Parish crushed and ground barite ore. Ores mined both domestically and abroad were shipped to Louisiana for processing. Ore processed in 1972 was up a substantial 14%, reflecting increased production in Orleans Parish. Unit value increased 18%. Virtually all the barite is used as a weight additive in well drilling muds.

Cement.—Shipments of portland and masonry cement increased 5.9% during 1972, down considerably from the 15% increase in 1971. Each of Louisiana's three plants produced both portland and masonry cement. Portland cement accounted for about 98% of the production. About 84% of the portland cement shipped was type I and II (general use and moderate heat); the remainder was type III (high-early-strength) and oil-well cement. Portland and masonry cement consumed in the State totaled 2,350,000 tons and 73,000 tons, respectively. Portland cement was consumed by ready-mix concrete companies (42%), highway contractors (21%), concrete product manufacturers (15%), building material dealers (2%), and other contractors and miscellaneous customers (20%). Raw materials used in making portland cement included oyster shells, limestone, sand, gypsum, and iron-bearing materials. All the plants used natural gas in their kilns.

Major producing companies were Ideal Cement Co., Lone Star Cement Corp., and Louisiana Cement Co., Div. of OKC Corp. The latter company started a $15 million expansion project at its New Orleans plant. Annual capacity will be increased by 357,000 tons to a total of 677,000 tons by the addition of a kiln 460 feet long, and two grinding mills, one for raw feed and the other for finished cement. Completion was scheduled for late 1973.

Clays.—Output of common clay and undifferentiated clay and shale decreased 7% to 1.0 million tons. Average unit value was $1.45 per ton. Twelve companies operated 14 pits in 13 parishes. Principal producing parishes in descending order of production were West Baton Rouge, Pointe Coupee and St. Bernard. Clay output was consumed in the manufacture of cement, lightweight aggregate, and heavy building brick.

Gypsum.—Crude gypsum was mined at Winnfield mine in Winn Parish by Winn Rock, Inc., and output was used as a retarder in portland cement. Unit price was down by 7% from that in 1971. Gypsum was calcined by National Gypsum Co. at its Jefferson Parish plant and United States Gypsum Co. at its Orleans Parish plant. Output, which increased 45% in 1972, was used in the manufacture of wallboard; the unit value was 3% lower than in 1971.

Lime.—Production decreased 5% to 907,616 tons whereas the unit value increased 18% to $21.60 per ton following a 47% increase in 1971. Olin Corp. produced hy-

Table 12.—Clays sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value
1968	863	1,163
1969	1,078	2,943
1970	1,080	1,575
1971	1,073	1,606
1972	1,000	1,454

drated lime (calcium hydroxide) at its Lake Charles plant. Allied Chemical Corp. produced quicklime (calcium oxide) at its Baton Rouge facilities. United States Gypsum Co. in Orleans Parish and Pelican State Lime Division of Radcliff Materials, Inc., in St. Mary Parish produced both quicklime and hydrated lime. Lime consumption in Louisiana which totaled 918,900 tons was used principally at chemical plants, aluminum smelters, and water purification facilities.

Texas Industries began core drilling at the Winnfield Minerals property on the Winnfield salt dome in Winn Parish. Earlier Texas Industries had signed a 90-day option to purchase the prospective limestone producing property.

Perlite.—Although not mined in Louisiana, perlite was expanded at two plants—Zonolite Division of W. R. Grace & Co. in Orleans Parish and Filter-Media Co. of Louisiana, Inc., in St. John the Baptist Parish. The latter is one of the principal producers of filter materials. A substantially smaller amount of perlite was expanded in 1972 than in 1971. Principal uses were for filter aids, low-temperature insulation, and horticultural aggregates. Other uses included plaster aggregate and concrete aggregate.

Salt.—Salt sold or used in Louisiana amounted to 13,514,000 tons in 1972, ranking the State first by accounting for 29.9% of the country's total. Since salt production was only 13,351,000 tons in 1972, salt stocks were drawn down by 162,000 tons.

Salt sold or used increased 1.2% and was valued at $67.4 million. The average unit value was $4.99 per ton, a 2.0% decline from that of 1971. Whereas rock salt production increased 6.0% during the year, brine salt and evaporated salt declined 2.5% and 2.2%, respectively. Average unit value in dollars per short ton were evaporated salt, $32.86; rock salt, $5.54; and salt brine, $3.46. Thirteen companies mined salt at 16 operations in 10 parishes. Of these, 10 operations produced brine, three produced both evaporated and rock salt, two produced rock salt only, and one produced evaporated salt only. Iberia Parish accounted for 86% of the evaporated salt and 26% of the total salt sold or used.

International Salt Co. dedicated new facilities at its Avery Island mine, including a concrete-lined, 1,000-foot shaft, an electrical hoist which lifts 18 tons of salt in 2 minutes, and a conveyor system for transporting the salt from the mine to a new barge-loading dock. The new facilities will provide for expanded current production as well as for projected future production.

Cargill Inc. completed a second shaft and costly renovations designed to make the Belle Island mine as safe as possible from fire. Fifty underground miners produced about 1.8 million tons of rock salt from the mine in 1971.[7]

Sand and Gravel.—Production was 18.9 million short tons, a 1.6% decline from that of 1971. Average unit value increased significantly to $1.43 per short ton. A total of 47 companies with 88 operations was reported in 41 of the State's 64 parishes. Leading parishes in descending rank of production were Washington, East Baton Rouge, St. Tammany, and Tangipahoa. These four parishes produced 32% of the State's output of sand and gravel. Commercial operations accounted for 98% of sand and gravel production.

Sand production of 8,605,000 short tons was a substantial 12% more than 1971 production. Unit value also increased, to $1.34 per ton. Principal uses of sand produced were building 62%, and paving, 28%. The remaining 10% was used as blast sand, glass sand, and engine sand.

Gravel production of 10.3 million short tons was 11% less than in 1971. Average unit value was $1.34 per ton, down $0.02 from 1971. Principal uses for produced gravel were building, 61%; and paving, 35%.

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[7] Sunday Advocate. Mar. 5, 1972, p. 14a.

Table 13.—Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Evaporated salt		Rock salt		Brine		Total	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1968 --------	293	7,183	4,793	26,556	5,822	20,115	10,908	53,854
1969 --------	277	7,598	5,237	29,160	6,921	24,344	12,435	61,102
1970 --------	270	7,888	5,581	32,459	7,733	24,507	13,584	64,854
1971 --------	275	9,399	5,794	32,976	7,288	25,574	13,352	[1] 67,950
1972 --------	269	8,840	6,142	34,032	7,104	24,592	[1] 13,514	67,464

[1] Data do not add to total shown because of independent rounding.

Table 14.—Louisiana: Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total[1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1968	20,208	26,354	203	150	20,411	26,504
1969	17,715	21,278	416	616	18,131	21,895
1970	17,746	21,527	410	836	18,155	22,363
1971	18,823	23,861	405	631	19,228	24,492
1972	18,538	26,255	383	740	18,920	26,996

[1] Data may not add to totals because of independent rounding.

Table 15.—Louisiana: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	W	W	120	720
Building	5,628	6,104	5,319	6,756
Fill	W	W	408	261
Paving	1,696	1,934	2,254	2,612
Other uses[1]	201	458	142	476
Total[2]	7,526	8,497	8,244	10,825
Gravel:				
Building	7,448	10,157	6,312	9,776
Paving	3,846	5,205	3,576	5,207
Other uses[3]	3	2	406	449
Total[2]	11,297	15,362	10,294	15,431
Government-and-contractor operations:				
Sand:				
Building	161	246	--	--
Fill	--	--	22	57
Paving	--	--	201	371
Other uses	--	--	138	256
Total	161	246	361	684
Gravel:				
Building	244	386	--	--
Fill	--	--	22	57
Total	244	386	22	57
Total sand and gravel[2]	19,228	24,492	18,920	26,996

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes glass (1971), molding, and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1972), fill (1972), miscellaneous, and other gravel.

Gifford-Hill & Co., Inc., started up a new aggregate plant about 20 miles southwest of Alexandria in Rapides Parish. The new facility will replace the nearby Turkey Creek operation which was terminated in late 1970 after having been in operation for 30 years.

Stone.—Production was principally crushed and broken clam and oyster shells. Output totaled 9,190,000 tons in 1972, a 5% decline from 1971. The value increased by $0.15 to $1.61. Most of the production was used as concrete and bituminous aggregate for highway construction and for the manufacture of cement and quicklime, and hydrated lime. Shell stone is produced in St. Mary, St. Tammany, Orleans, and Cameron Parishes, of which the first two accounted for 87% of the total. Quarried stone is also produced in Winn Parish.

Sulfur.—After leading the Nation in Frasch sulfur production for nearly a decade, Louisiana dropped to second, following Texas, in 1972 when the State's six plants produced 3,534,000 long tons, down 2% from that produced in 1971. The share of total U.S. Frasch sulfur mined in Louisiana fell to 48.5% in 1972 compared with 51.5% in 1971. Sulfur stocks in the State were reduced as shipments increased 3% during the year.

During the year the production of recovered sulfur more than doubled, reflecting primarily startup of a sulfur recovery plant at the Baton Rouge refinery of Exxon

Co. U.S.A. and a full year of operation of the new recovery plant at the Cities Service Co. Lake Charles refinery. The new Exxon plant was designed to produce 170 tons per day of elemental sulfur and includes spare capacity to handle additional anticipated requirements. The recovery plant and attendant facilities cost about $5.1 million.

Table 16.—Louisiana: Sulfur produced and shipped from Frasch mines

(Thousand long tons and thousand dollars)

Year	Production	Shipments	
		Quantity	Value [1]
1968	4,255	[r] 4,060	[r] 162,055
1969	3,857	[r] 3,924	[r] 106,261
1970	3,636	[r] 3,660	[r] 90,488
1971	3,616	[r] 3,646	W
1972	3,534	3,765	W

[r] Revised. W Withheld to avoid disclosing individual company confidential data.
[1] F.o.b. mine plant.

Sulfur recovery facilities completed in 1971 by Cities Service Co. at Lake Charles consisted of a 25,000-barrel-per-day cycle oil hydrodesulfurization unit, an amine system, and two 50-ton-per-day sulfur recovery units. The elemental sulfur recovered is used as feed to the refinery's sulfuric acid plant. These units together with the ones completed by Exxon will lower the sulfur content of fuels produced as well as contribute to air pollution abatement.

The original Frasch sulfur mine was closed for the second time. The old Union Sulfur Co. plant at Sulfur was the site where Hermann Frasch in 1895 perfected the Frasch method of sulfur extraction. In 1924 reserves were nearly depleted and the mine was closed. In 1966, when sulfur was in high demand and prices were high, Union Texas Petroleum Division of the Allied Chemical Corp. reopened the mine to obtain feedstock for their petrochemical plant at Geismar. During the 6 years it was reopened it was worked as a stripping operation, because the recovery holes were no longer operational.

Sulfur industry sources indicated that the Nation's impending natural gas shortage could force some Louisiana Frasch sulfur operators to reduce production. Specifically mentioned was the Texas Gulf, Inc., mine at Billy Camp, La., which produces about 3% of total U.S. sulfur output. The natural gas supply to this mine comes through an interstate pipeline which is under the jurisdiction of and regulated by the Federal Power Commission (FPC). In the past, natural gas regulatory agencies, both Federal and State, have ruled that in shortage situations priority should be given to residential and institutional consumers rather than to large industrial consumers. The 14 Frasch sulfur operations in the United States produce about 70% of the Nation's total sulfur output and are especially vulnerable to shortage because they burn about 50 billion cubic feet of natural gas per year. Late in the year, FPC ordered the United Gas Pipe Line Co. to reduce its supply of natural gas to the mine by 15%. Texas Gulf, Inc., has a long-term contract which calls for the pipeline company to meet all of the mine's requirements up to 20 million cubic feet per day for 20 years.[8]

Construction of a new sulfuric acid plant at the Uncle Sam plant of Freeport Chemical Co. began near yearend. The $8.6 million plant will use sulfur mined both onshore and offshore Louisiana. The acid will be used to process phosphate rock from Florida into phosphoric acid for use in fertilizer plants.

METALS

Aluminum.—Bauxite received from out-of-State sources is processed into alumina at the Gramercy and Baton Rouge plants of Kaiser Aluminum & Chemical Corp. (Kaiser) and at the Burnside plant of Ormet Corp. Only the Chalmette plant of Kaiser produced aluminum. Aluminum production increased 4% during 1972, to maintain its ranking as fourth in the Nation.

A Federal court in Louisiana approved the arrangement between Kaiser Aluminum & Chemical Corp. and EPA that will halt the discharge of spent bauxite into the Mississippi River. Early in the year Kaiser developed a method for handling the red residue that remains after the alumina has been recovered. The spent material will be piped as a slurry to storage areas, dewatered, and used for landfill and other purposes. The company has agreed to deadlines of July 1, 1974, for its Gramercy plant and July 1, 1975, for its Baton Rouge plant.

Nickel.—American Metal Climax, Inc. (AMAX), which purchased the shutdown Port Nickel Refinery at Braithwaite in 1971, announced that renovations should be completed in early 1974. The plant is 20 miles downriver from New Orleans. The Bamangwato Concessions, Ltd., mine in the African country of Botswana is expected to begin producing a nickel-copper matte with a projected mine output of 2.2 million tons of ore annually during the first 10 years of operation and will supply about 54,000 tons of matte per year. Nickel will be produced as powder, briquets, and cathodes, and copper will be produced as powder, briquets, and wire bar. A small amount of cobalt will also be produced as metal, metal briquets, and oxide powders. The plant will provide jobs for 325 persons and will have a payroll of about $4 million annually. The 660-acre refinery site has 3,600 feet of Mississippi River frontage and docking facilities that can handle ships up to 35,000 deadweight tons.

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[8] Chemical Week. V. 8, No. 25, Dec. 20, 1972, p. 10.

Table 17.—Principal producers and processors of minerals

Commodity and company	Address	Type of activity	Parish
Aluminum:			
Kaiser Aluminum & Chemical Corp.	P.O. Box 1600 Chalmette, La. 70043	Reduction plant	St. Bernard.
Ormet Corp	P.O. Box 15 Burnside, La. 70738	do	Calcasieu.
Barite:			
Dresser Minerals	P.O. Box 6504 Houston, Tex. 77005	Grinding plant	Orleans and Calcasieu.
Milchem, Inc	P.O. Box 22111 Houston, Tex. 77027	do	Orleans.
NL Industries; Baroid Div	Box 1675 Houston, Tex. 77001	do	Do.
Carbon black:			
Ashland Chemical Co	P.O. Box 1503 Houston, Tex. 77005	Furnace plant	St. Mary.
Cabot Corp	125 High St. Boston, Mass. 02110	do	St. Mary and Evangeline.
Columbian Carbon Co	380 Madison Ave. New York, N.Y. 10017	do	Ouachita, Avoyelles, St. Mary.
Continental Carbon Co	P.O. Box 22085 Houston, Tex. 77027	do	Calcasieu.
Sid Richardson Carbon & Gasoline Co.	1200 Ft. Worth National Bank Bldg. Fort Worth, Tex. 76102	do	West Baton Rouge.
Thermatomic Carbon Co	245 Park Ave. New York, N.Y. 10017	do	Ouachita.
Cement:			
Ideal Cement Co., Div. Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo 80202	Plant	East Baton Rouge.
Lone Star Cement Corp	P.O. Box 47327 Dallas, Tex. 75247	do	Orleans.
Louisiana Cement Co., Div. OKC Corp.	14900 Intracoastal Dr. New Orleans, La. 70129	do	Do.
Clays:			
Acme Brick Co	Box 425 Ft. Worth, Tex. 76101	Mine and plant	East Baton Rouge.
Athens Caddo Brick Co	Box 70 Athens, Tex. 75751	do	Caddo.
Big River Industries, Inc	Box 66377 Baton Rouge, La. 70806	do	Pointe Coupee.
Dixie Brick, Inc	Box 969 Natchitoches, La. 71457	do	Bienville and Natchitoches.
Hammond Baton Rouge Brick Co.	Box 329 Hammond, La. 70401	do	Tangipahoa.
Ideal Cement Co., Div. Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	West Baton Rouge.
Kentwood Brick & Tile Manufacturing Co., Inc.	Drawer F Kentwood, La. 70444	do	St. Helena.
Louisiana Cement Co., Div. of OKC Corp.	14900 Intracoastal Dr. New Orleans, La. 71029	do	St. Bernard.
Gypsum:			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Calcining plant	Jefferson.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Orleans.
Winn Rock, Inc	P.O. Box 790 Winnfield, La. 71483	Quarry and plant	Winn.
Lime:			
Allied Chemical Corp	P.O. Box 70 Morristown, N.J. 07960	do	East Baton Rouge.
Olin Corp	P.O. Box 2896 Lake Charles, La. 70601	do	Calcasieu.

See footnotes at end of table.

Table 17.—Principal producers and processors of minerals—Continued

Commodity and company	Address	Type of activity	Parish
Lime—Continued			
Pelican State Lime Division of Radcliff Materials, Inc.	P.O. Box 1637 Morgan City, La. 70380	Quarry and plant.	St. Mary.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	----do---------	Orleans.
Natural gas and petroleum:[1]			
Salt:			
Allied Chemical Corp., Industrial Chemical Div.	Box 70 Morristown, N.J. 07960	Brine wells ----	Iberville.
BASF Wyandotte Chemicals Corp.	1609 Biddle Ave. Wyandotte, Mich. 48192	----do---------	Ascension.
The Carey Salt Co	1800 Carey Blvd. Hutchinson, Kans. 67501	Underground mine.	St. Mary.
Cargill, Inc	Cargill Building Minneapolis, Minn. 55402	----do---------	Do.
Diamond Crystal Salt Co., Jefferson Island Div.	916 Riverside Ave. St. Clair, Mich. 48079	----do---------	Iberia.
The Dow Chemical Co	Midland, Mich. 48640	Brine wells ----	Iberville.
Freeport Sulphur Co	Box 61520 New Orleans, La. 70160	----do---------	Plaquemines, Jefferson, Terrebonne.
Gordy Salt Co., Inc	Box 638 New Iberia, La. 70560	----do---------	St. Martin.
International Salt Co., Avery Mine & Refinery.	Clarks Summit, Pa. 18411	Underground mine.	Iberia.
Kaiser Aluminum & Chemical Corp.	900 17th St., N.W. Washington, D.C. 20006	Brine wells ----	Ascension.
Morton Salt Co	110 North Wacker Dr. Chicago, Ill. 60606	Underground mine.	Iberia.
Olin Corp	Box 991 Little Rock, Ark 72203	Brine wells ----	Cameron.
PPG Industries, Inc., Industrial Chemical Div.	Box 1000 Lake Charles, La. 70604	----do---------	Calcasieu.
Sand and gravel:			
Braswell Sand & Gravel Co., Inc.	Box 798 Minden, La. 71055	Stationary ----	Webster.
Gifford-Hill & Co., Inc	Box 47127 Dallas, Tex. 75247	Stationary and dredge.	Jefferson, Davis, Webster, Tangipahoa.
Dixie Sand and Gravel Co	P.O. Box 847 Baton Rouge, La. 70821	Stationary ----	Washington.
Louisiana Sand and Gravel Co.	P.O. Box 963 Baton Rouge, La. 70800	2 portable and 4 dredge.	East Baton Rouge.
Mid-State Materials	Box 7177 Alexandria, La. 71301	2 dredge ------ Stationary ----	Rapides. Ouachita.
Monroe Sand and Gravel, Inc.	Box 246 West Monroe, La.	----do---------	Do.
Rapides Sand and Gravel Co.	P.O. Box 847 Baton Rouge, La. 70821	----do---------	East Baton Rouge.
Red Stick Gravel Co	Box 847 Baton Rouge, La. 70821	----do---------	Do.
Standard Gravel Co., Inc	Rt. 4, Box 17 Franklinton, La. 70438	----do---------	Washington.
Trinity Concrete Products	Box 47524 Dallas, Tex. 75247	Stationary and dredge.	Beauregard.
Shell:			
Ayers Materials Co., Inc	P.O. Box 382 Harvey, La. 70058	Dredge --------	St. Tammany.
W. T. Burton Industries, Inc.	P.O. Box 100 Sulphur, La. 70663	----do---------	Cameron.
Ideal Cement Co., Div. Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	----do---------	St. Mary.
Lake Charles Dredging & Towing Co.	Lafayette, La. 70501	----do---------	Do.
Louisiana Materials Co	P.O. Box 8214 New Orleans, La. 70122	----do---------	St. Tammany.
Radcliff Materials, Inc.	P.O. Drawer 946 Mobile, Ala. 36601	----do---------	Orleans.
Stone: Winn Rock, Inc	P.O. Box 790 Winnfield, La. 71483	Quarry and plant.	Winn.

See footnotes at end of table.

Table 17.—Principal producers and processors of minerals—Continued

Commodity and company	Address	Type of activity	Parish
Sulfur, native:			
Freeport Sulphur Co	161 East 42d St. New York, N.Y. 10017	Frasch process	Jefferson, Plaquemines, Terrebonne.
Texas Gulf, Inc	200 Park Ave. New York, N.Y. 10017	do	Lafourche.
Sulfur, recovered:			
Shell Oil Co	Box 60673 New Orleans, La. 71060	Secondary recovery.	St. Charles.
Humble Oil & Refining Co	P.O. Box 551 Baton Rouge, La. 70821	Stationary	East Baton Rouge.
Vermiculite: W.R. Grace & Co., Zonolite Div.	62 Whittemore Ave. Cambridge, Mass. 02140	Exfoliating plant.	Orleans.

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[1] Most major companies and many smaller companies operate in Louisiana. Commercial directories contain listings of operators.

The Mineral Industry of Maine

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Maine, for collecting information on all minerals except fuels.

By Frank B. Fulkerson [1]

Mineral production in Maine in 1972 was valued at $22.9 million, an increase of $1 million, or 5% over that of 1971. Copper, zinc, cement, sand and gravel, and stone were the principal mineral commodities produced; they supplied more than 90% of the State total value. Clays, gem stones, lead, peat, and silver also contributed to the State's mineral production. Among the States, Maine ranked 47th in value of mineral output.

A number of major companies were exploring for metallic mineral deposits in Maine. International Paper Co., a significant landholder in the State, continued geologic evaluation of its own properties, including a silver-copper prospect at Square Lake in northeast Aroostook County. A nickel-copper deposit near Union was the subject of exploration by Hanna Mining Co. and Basic, Inc., both of Cleveland. Callahan Mining Co. continued a program of minerals investigation. Several field crews representing mineral divisions of large petroleum companies were active in northern Maine.

In 1972 Portland was the third largest oil port on the east coast, after Philadelphia and New York. About 30 million tons of petroleum and petroleum products were handled. The bulk of the traffic was crude oil from South America and the Middle East that was unloaded from tankers at Portland and piped to Canada through the Portland-Montreal pipeline system. Shipments of refined products from the gulf coast were received at Portland for storage and distribution.

The Maine Yankee Atomic Power Co. plant at Wiscasset went into commercial operation late in the year, licensed to operate at 75% of capacity for 18 months. The 885,000 kilowatt facility is the sixth commercial nuclear powerplant in New England.

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[1] Industry economist, Division of Nonmetallic Minerals.

Table 1.—Mineral production in Maine [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays .... thousand short tons..	[2] 42	[2] $56	40	$57
Copper .... short tons..	2,510	2,610	1,220	1,249
Gem stones	NA	40	NA	W
Lead .... short tons..	--	--	85	26
Peat .... thousand short tons..	2	W	2	99
Sand and gravel .... do....	8,292	5,881	11,818	7,535
Silver (recoverable content of ores, etc.) thousand troy ounces..	41	64	16	27
Stone .... thousand short tons..	1,133	2,913	1,078	2,996
Zinc .... short tons..	5,850	1,884	5,820	2,066
Value of items that cannot be disclosed: Other nonmetals and values indicated by symbol W..	XX	8,450	XX	8,867
Total	XX	21,898	XX	22,922
Total 1967 constant dollars	XX	18,620	XX	^{p}19,069

NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes certain clay; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Maine, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Androscoggin	$877	$880	Sand and gravel, clays.
Aroostook	417	W	Sand and gravel.
Cumberland	2,202	2,498	Stone, sand and gravel, clays.
Franklin	207	311	Sand and gravel.
Hancock	4,927	3,389	Zinc, copper, sand and gravel, stone, peat, silver, lead, clays.
Kennebec	1,584	W	Sand and gravel, stone.
Knox	W	W	Cement, stone, sand and gravel.
Lincoln	W	94	Sand and gravel.
Oxford	W	W	Do.
Penobscot	453	1,406	Do.
Piscataquis	W	W	Stone, sand and gravel.
Sagadahoc	W	W	Sand and gravel.
Somerset	W	W	Do.
Waldo	--	W	Do.
Washington	W	141	Sand and gravel, peat.
York	W	W	Sand and gravel, stone.
Undistributed [1]	11,231	13,701	
Total	21,898	[2] 22,922	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes value of gem stones, sand and gravel, and stone that cannot be assigned to specific counties and values indicated by symbol W.

[2] Data may not add to total shown because of independent rounding.

Table 3.—Indicators of Maine business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force .... thousands	416.3	419.0	+0.6
Unemployment .... do	31.8	30.3	−4.7
Employment:			
Manufacturing .... do	102.8	103.4	+0.6
Durable goods .... do	31.0	32.3	+4.2
Nondurable goods .... do	71.1	71.9	+1.1
Nonmanufacturing .... do	227.5	232.0	+2.0
Personal income:			
Total .... millions	$3,614	$3,675	+1.7
Per capita	$3,375	$3,571	+5.8
Portland cement shipments to and within Maine .... thousand short tons	228	257	+12.7
Mineral production value .... thousands	$21,898	$22,922	+4.7

p Preliminary.

Sources: Survey of Current Business; Area Trends in Employment and Unemployment; New England Economic Indicators; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	75	279	21	167	--	6	35.90	1,322
Nonmetal	74	179	13	106	--	8	75.57	2,645
Sand and gravel	780	189	147	1,267	--	13	10.26	249
Stone	320	290	93	750	2	24	34.66	16,501
Total	1,249	220	274	2,290	2	51	23.14	5,761
1972:[1]								
Metal	70	193	14	111	--	6	54.04	1,153
Nonmetal	65	184	12	95	--	6	62.90	262
Sand and gravel	275	185	51	457	--	6	13.14	149
Stone	195	284	55	451	1	13	31.03	13,726
Total	605	218	132	1,114	1	31	28.72	5,757

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—The new $18 million cement plant of Martin Marietta Corp. at Thomaston completed its first year of operation. The 2.5-million-barrel plant, which features nearly $3 million in dust suppression devices, was erected to replace the existing facility at the same site. The old, obsolete production unit, which had an annual capacity of 2 million barrels, was dismantled in 1972. Cement shipments were made by rail and truck from Thomaston to Maine, New Hampshire, and Massachusetts. Most of the product was shipped in bulk. Sizable quantities were shipped by rail from Thomaston to the company's storage and distribution terminal at Wilmington, Mass. Ready-mixed concrete companies, building materials dealers, and concrete products manufacturers were the principal consumers.

Clays.—Output of miscellaneous clay was virtually the same as in 1971. Production was from three pits in Cumberland County and two pits in Androscoggin County for use in building brick. Leading clay producers were Lachance Bros. Brick Co. and Morin Brick Co. A small quantity of kaolin was produced in Hancock County for use in making pottery.

Gem Stones.—An important discovery of tourmaline was made on Newry Mountain near Rumford in Oxford County. The operators took out a sizable quantity of the gem stones before the project was shut down for the winter. Mineral localities, mostly old mines, quarries, and dumps in the western portion of the State, continued to attract rockhounds, who collected specimens of tourmaline, lepidolite, quartz, feldspar, apatite, garnet, and chrysoberyl. A book was published on Oxford County's gems and minerals.[2]

Peat.—Peat sales were approximately the same as those of 1971. Most of the Maine peat was packaged and sold for use by homeowners and landscape contractors in soil conditioning. Bogs were operated by Acadia Peat Corp., Penobscot, International Peat Moss Co., Inc., Jonesport, and Eric Kelley Peat Moss Co., Centerville. It was of interest that each producer used a different method of harvesting the peat. Acadia used earthmoving machinery and thermal drying. International cut the peat into blocks, which were stacked for air drying. At the Kelley operation, the peat was harrowed, and, after drying in the field, was picked up by vacuum-type machines.

Perlite.—Crude perlite mined in New Mexico was expanded by Chemrock Corp. at Thomaston for use as a filtration medium. The company was exploring the possibility of importing crude perlite from Greece to save on transportation costs.

Sand and Gravel.—Production of sand and gravel increased 43% in tonnage and 28% in value, as the result of greater output of paving gravel. About 11.8 million tons of sand and gravel was produced, as compared with 8.3 million tons in 1971. The production was 5.5 million tons below the record high of 17.3 million tons in 1965. Value per ton dropped from 71 cents in 1971 to 64 cents in 1972. Cumberland, Kennebec, and Penobscot Counties each produced more than 1 million tons of sand and gravel. A total of 64 commercial and 23 Government-and-contractor operations were active.

Stone.—Stone production decreased 5% in quantity but increased 3% in value. Crushed limestone was produced for use in cement production, soil improvement, poultry feed, and paper manufacturing, as well as for concrete and bituminous aggregate. Granite and traprock were crushed for aggregate purposes. Leading crushed stone producers were Blue Rock Industries, Cook Concrete Co., Lime Products Corp., and Martin Marietta Corp. Leading crushed-stone-producing counties were Cumberland and Knox. Dimension slate was recovered in Piscataquis County by Portland-Monson Slate Co. for floor tile. The John Swenson Granite Co. reported production of rough granite blocks from quarries in Hancock, Knox, and York Counties. A quantity of dimension granite was produced by Perini Corp. from the old Settlement quarry at Stonington, Hancock County. Owing to a lack of markets, the operation was suspended in September.

METALS

Production was begun late in 1972 at the Blue Hill zinc-copper mine and flotation mill, Hancock County. This mine was first developed in the 1960's but there had been no production. In October 1972 Kerr-american, Inc., completed a 2½-year, $6 million project to drive an inclined entry to the former workings and erect a mill with a capacity of 1,000 tons per day. A trackless mining method was being used. Broken ore was loaded into dump trucks and brought to the surface for milling. By the end of 1972 53,000 tons of ore averaging 9.9% zinc and 0.56% copper had been milled. Zinc concentrate was shipped for smelting to National Zinc Co., Bartlesville, Okla., and copper concentrate was shipped to Gaspé Copper Mines, Ltd., Gaspé, Quebec. A small quantity of silver was contained in the concentrates.

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[2] Stevens, J. P. Maine's Treasure Chest. Perham's Maine Mineral Store, West Paris, Maine, 1972, pp. 216.

At yearend, ore reserves were estimated at 1.6 million tons. The main zone was estimated to contain 682,000 tons of 14% zinc and 0.4% copper, and another 223,000 tons of 9.4% zinc and 1.4% copper. Other zones were calculated at 147,000 tons averaging 15.9% zinc and 2.1% copper, 366,000 tons averaging 1.2% zinc and 2.1% copper, and 150,000 tons averaging 2.2% copper.

In July, Callahan Mining Co. permanently closed its zinc-copper open pit operation and flotation mill at Harborside, Hancock County, owing to depletion of ore reserves. The mine, which was the first base metal mining operation of significance in Maine since the turn of the century, was productive only about 5 years. As part of a landmark reclamation effort, the open pit, under Goose Cove, was flooded by tidal water and a program of aquaculture was initiated with seed oysters and salmon fingerlings.

Table 5.—Maine: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	592	594	439	573
Engine	W	W	3	5
Fill	412	240	319	141
Paving	670	690	830	782
Other uses [1]	81	76	148	99
Total [2]	1,755	1,600	1,738	1,600
Gravel:				
Building	575	710	659	975
Fill	161	108	290	149
Paving	960	1,341	1,058	1,289
Miscellaneous	W	W	289	332
Other uses [3]	416	450	91	50
Total [2]	2,111	2,609	2,388	2,795
Government-and-contractor operations:				
Sand:				
Building	1	2	--	--
Fill	26	6	10	2
Paving	1,472	614	1,442	558
Other uses	35	10	33	8
Total [2]	1,534	632	1,486	569
Gravel:				
Building	23	20	--	--
Fill	34	10	30	7
Paving	2,836	1,010	6,176	2,565
Total	2,893	1,040	6,206	2,572
Total sand and gravel [2]	8,292	5,881	11,818	7,535

W Withheld to avoid disclosing individual company confidential data; included with "Other uses".

[1] Includes other industrial sand.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast and other gravel.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Dragon Cement Co., Division of Martin Marietta Corp.[1]	5A Joyce Kilmer Ave. New Brunswick, N.J. 08901	Plant	Knox.
Clays:			
Dennis Brick Co., Inc	R.F.D. No. 1 33 Old Washington Rd. Auburn, Maine 04210	Pit	Androscoggin.
Lachance Bros. Brick Co	R.F.D. No. 2 Gorham, Maine 04038	Pit	Cumberland.
Morin Brick Co	Danville, Maine 04223	Pit	Androscoggin.
Royal River Brick Co., Inc.	Box 191 Gray, Maine 04039	Pit	Cumberland.
Peat:			
Acadia Peat Corp	Penobscot, Maine 04476	Bog	Hancock.
International Peat Moss Co., Inc.	430 Trapelo Rd. Belmont, Mass. 02178	Bog	Washington.
Perlite (expanded):			
Chemrock Corp	End of Osage Street Nashville, Tenn. 37208	Plant	Knox.
Sand and gravel:			
Blue Rock Industries	58 Main Street Westbrook, Maine 04092	Pit	Androscoggin, Cumberland.
Harry C. Crooker & Sons, Inc.	Brunswick, Maine 04011	Pit[2]	Do.
D. J. Gurney Inc	Rt. 1 River Road Waterville, Maine 04901	Pit	Somerset.
Hamlin Sand & Gravel Co., Inc.	920 Riverside St. Portland, Maine 04103	Pit[3]	Cumberland.
Lewiston Crushed Stone Co., Inc.	South Ave. Lewiston, Maine 04240	Pit[2]	Androscoggin.
Harold C. MacQuinn, Inc.	Bar Harbor, Maine 04609	Pit	Hancock.
Portland Sand & Gravel Co., Inc.	Gray Road Cumberland, Maine 04021	Pit	Cumberland.
Leroy S. Prout Sand & Gravel.	Scarborough, Maine 04074	Pit	Do.
Maynard W. Robinson & Sons.	R.F.D. No. 2 Cumberland Center, Maine 04021	Pit	Do.
Frank Rossi & Sons, Inc	National Bank Bldg. Gardiner, Maine 04345	Pit	Various.
Warren Bros. Company	Fairfield, Maine 04937	Pit	Kennebec.
Stone:			
Granite, dimension:			
Perini Corp., Marine Div.	62 Condor St. E. Boston, Mass. 02128	Quarry	Hancock.
The John Swenson Granite Co. Inc.	North State St. Concord, N.H. 03301	do	York, Knox.
Granite, crushed:			
Cook and Co., Inc	150 Causeway St. Boston, Mass. 02114	do	Cumberland.
Limestone, crushed:			
Blue Rock Industries	58 Main St. Cumberland Mills, Maine 04092	do	Kennebec.
Dragon Cement Co., Division of Martin Marietta Corp.	5A Joyce Kilmer Ave. New Brunswick, N.J. 08901	do	Knox.
Lime Products Corp	P.O. Box 357 Union, Maine 04862	do	Do.
Miscellaneous, crushed:			
Blue Rock Industries	58 Main St. Cumberland Mills, Maine 04092	do	Cumberland.
Slate, dimension:			
Portland-Monson Slate Co.	Middle Granville, N.Y. 12849	Underground	Piscataquis.
Zinc:			
Callahan Mining Corp[4]	Harborside, Maine 04642	Pit and underground.	Hancock.

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[1] Portland and masonry.
[2] 2 pits.
[3] 3 pits.
[4] Also copper and silver.

The Mineral Industry of Maryland

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Maryland Geological Survey for collecting information on all minerals in the State.

By Charles L. Klingman[1]

The value of mineral production in Maryland was 16% greater in 1972 than it was in 1971. The total value of 1972 mineral production was $115.5 million. Stone was again the most valuable mineral product of the State, comprising 36% of the State's total. Stone totaled 19,431,000 tons in quantity and was valued at $41,973,000.

Sand and gravel contributed 23% of the State's mineral wealth in 1972. Production of sand and gravel totaled 12,594,000 tons, and was valued at $26,557,000.

Portland and masonry cement contributed significantly to the mineral economy of Maryland in 1972. There were substantial increases in production and in value of both types of cement.

Bituminous coal production remained virtually constant, but clay showed a 7% increase in production in 1972 over that of 1971. All other mineral production in Maryland was too small to affect the State total greatly.

Prices, or mill evaluation, of the minerals increased on many of the large-volume items such as sand and gravel, cement, and clays. Unit evaluations declined, however, on stone and coal.

Baltimore County led the State in the value of mineral production. It was followed in order by Frederick, Washington, and Prince Georges Counties.

Employment and Injuries.—The total number of people employed by the mineral industries of Maryland increased 5% in 1972 compared with the number of those employed in 1971.

A combination of the data shown in Table 4 and information give in the Annual Report of the Maryland Bureau of

Table 1.—Mineral production in Maryland[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays[2] ....thousand short tons..	1,027	[3] $1,558	1,104	$2,121
Coal (bituminous) ....do....	1,644	10,274	1,640	8,961
Gem stones	NA	8	NA	8
Natural gas ....million cubic feet..	214	[r] 43	244	51
Peat ....thousand short tons..	3	39	3	29
Sand and gravel ....do....	12,842	23,201	12,594	26,557
Stone ....do....	15,912	34,770	19,431	41,973
Value of items that cannot be disclosed:				
Cement (portland and masonry), ball clay, lime, greensand marl (1971), and talc and soapstone..	XX	29,527	XX	35,801
Total	XX	[r] 99,420	XX	115,501
Total 1967 constant dollars	XX	84,537	XX	[p] 96,085

[p] Preliminary. [r] Revised. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes ball clay; included with "Value of items that cannot be disclosed."

[3] Excludes kaolin; included with "Value of items that cannot be disclosed."

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[1] Physical scientist, Division of Nonmetallic Minerals—Mineral Supply.

Table 2.—Value of mineral production in Maryland, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Allegany	$3,184	$3,885	Coal, stone, sand and gravel.
Anne Arundel	2,308	2,846	Sand and gravel.
Baltimore[2]	16,327	21,550	Stone, sand and gravel, clay.
Calvert	W	5	Sand and gravel.
Caroline	W	W	Do.
Carroll	W	W	Cement, stone, clay, sand and gravel.
Cecil	6,515	6,332	Stone, sand and gravel.
Charles	W	W	Sand and gravel.
Dorchester	W	189	Do.
Frederick	11,701	15,057	Cement, stone, clay, lime, sand and gravel.
Garrett	r 9,421	6,660	Coal, stone, peat.
Harford	2,171	1,471	Sand and gravel, stone, clay, talc.
Howard	W	1,206	Stone.
Kent	30	16	Clay.
Montgomery	W	W	Stone.
Prince Georges	10,364	13,061	Sand and gravel, clay, stone.
St. Marys	W	W	Sand and gravel.
Somerset	W	W	Do.
Washington	W	14,819	Cement, stone, clay, sand and gravel.
Wicomico	W	W	Sand and gravel.
Worcester	--	13	Do.
Undistributed[3]	37,402	28,393	
Total[4]	r 99,420	115,501	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Queen Annes and Talbot Counties are not listed because no production was reported.

[2] Includes Baltimore City.

[3] Includes sand and gravel and stone, which cannot be assigned to specific counties, gem stones, natural gas, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Maryland business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force thousands	1,538.9	1,575.2	+2.4
Unemployment do	75.5	78.6	+4.1
Employment:			
Manufacturing do	252.1	247.8	−1.7
Transportation and public utilities do	80.2	78.9	−1.6
Trade do	316.0	329.9	+4.4
Finance, insurance, and real estate do	70.6	74.2	+5.1
Mining do	2.0	2.1	+5.0
Contract construction do	93.9	96.9	+3.2
Services do	245.4	256.4	+4.5
Government do	255.7	265.1	+3.7
Payroll, average weekly earnings: Manufacturing	$143.71	$157.58	+9.7
Personal income:			
Total millions	$18,119	$19,861	+9.6
Per capita	$4,522	$4,897	+8.3
Construction activity:			
Cement shipments to and within Maryland thousand short tons	1,509	1,550	+2.7
Mineral production value thousands	r $99,420	$115,501	+16.2

p Preliminary. r Revised.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

Mines[2] indicate that there was a total of 112 lost-time injuries during 1972 in the mineral industries of Maryland compared with 102 such injuries in 1971. The overall accident frequency rate was higher in 1972 than that of 1971. In 1972 there was one fatal accident in the stone industry.

Legislation and Government Programs.—A new State agency, the Maryland Environmental Service, was created to regulate pollution from liquid and solid wastes. The agency covers services from planning, design, financing, construction, and operation, to maintenance of all liquid and solid waste control installations. Comprehensive plans for river basin projects must be submitted to this agency by July 1973 and for solid

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[2] Calendar Year 1972, Fiftieth Annual Report of the Maryland Bureau of Mines, Harry B. Buckley, Director, pp. 15 and 16.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	330	230	76	618	--	5	8.09	NA
Nonmetal	124	287	29	235	--	6	25.55	319
Sand and gravel	729	259	189	1,699	--	50	29.43	553
Stone	1,255	274	343	2,873	--	41	14.27	612
Total [1]	2,438	262	638	5,424	--	102	18.80	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Nonmetal	120	249	30	240	--	17	70.87	629
Sand and gravel	495	264	130	1,176	--	30	25.50	3,362
Stone	735	281	206	1,721	1	59	34.86	4,143
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

waste disposal by January 1974. This agency is likely to have great influence on future mining and quarrying activities in the State.

The Baltimore Gas and Electric Co. continued to have difficulties in the construction of its Calvert Cliffs nuclear powerplant. It is now estimated that the plant will cost about $200 million more than the original estimate, and the startup date will be delayed about 2 years. This company has postponed indefinitely its plans to build another $700 million nuclear powerplant in Harford County. One of the reasons given for cancellation of the Harford County plant was "continued changing requirements of the Atomic Energy Commission and other regulatory agencies" and also "continued opposition of environmental groups."

Plans were formulated for a training school for small strip mine operators to aid them in health and safety and applicable laws pertaining to their business.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Consumption of portland cement in Maryland in 1972 was 1,432,000 tons, a 2% increase over that of 1971; masonry cement was 118,000 tons, 12% greater than that of 1971. A portion of the cement consumed in Maryland, however, came from other States. Portland cement production for the State increased 9% and the average value increased 11% in 1972 compared with 1971 figures. Masonry cement production increased 13%, and its average value rose 10% in 1972 over that of 1971.

Approximately 13% of the State's limestone production for 1972 went into making cement. Other raw materials consisted of clay, shale, gypsum, and iron-bearing materials. The cement manufacturing plants used large quantities of fuel oil, coal, and electric power to convert these materials into cement. General-use and moderate-heat types of cement comprised 97% of the portland cement production. High-early-strength cement made up the remaining 3%. Masonry cement comprised about 6% of the total cement production.

By far the largest portion of the cement production, over 70%, went to the ready-mix concrete companies, and this percentage increased 1.5% during 1972. Over 21% of the production went to manufacture concrete products such as concrete blocks, flagstones, and preformed building beams. The combined portion, which went to highway construction, contractors, and government agencies, was about 5% of the total, down 3.5% from 1971.

Portland cement was produced at three plants in Maryland, one of which also produced masonry cement. Another plant produced masonry cement exclusively.

Clays.—Production of clays of all types in Maryland, excluding ball clay, increased 7.5% in tonnage. There were 10 companies operating 12 pits in 7 counties during the year. About 34% of the clay production went into the manufacture of face brick. The remaining 66% of the clay went into the manufacture of ceramic tile, common brick, lightweight aggregates, fire brick, cement, and pottery.

Frederick County produced over half the clay of the entire State. Other major clay-producing counties are as follows, in the order of output: Carroll, Prince Georges, Washington, and Baltimore.

Diatomite.—There was no commercial production of diatomite in Maryland in 1972. There was a rather extensive diatomite bed known to exist along Popes Creek in Calvert, Prince Georges, and Charles Counties. It is possible that this deposit may be mined some time in the future.

Gem Stones.—Production of semiprecious stones was limited to small quantities collected by dealers and amateur collectors. The total value of such stones was estimated at $8,000 in 1972.

Lime.—S. W. Barrick & Sons, Inc., produced lime in Frederick County for agriculture in 1972. Output decreased 11% and was well below the 1965 record. The lime was consumed in Maryland, Virginia, Delaware, and Pennsylvania. Total consumption of lime in Maryland was 406,900 tons.

Perlite.—Relatively small amounts of crude perlite obtained from western states was expanded at two plants in Prince Georges County and at one plant in Baltimore County. The average mill value of the expanded perlite was $93.22 per short ton, up 16% over the 1971 value.

Less than half of the expanded perlite production went into plaster aggregate, and just over 40% went into concrete mixtures to provide a lightweight aggregate. The remaining 10% was divided among horticultural uses, masonry, and low-temperature insulation. The production of perlite in Maryland decreased 18% in 1972 compared with that of 1971.

Sand and Gravel.—Production of sand and gravel was 2% less in 1972 than that of 1971, but a general increase in unit value caused the total value of sand and gravel to be 14% higher than that of 1971. The average price of sand increased 12% and gravel increased 22%.

The five top-ranking counties in the order of production were as follows: Prince Georges, Baltimore, Cecil, Anne Arundel, and Charles. Forty-nine companies operated a total of 70 sand and gravel pits in Maryland during 1972.

In 1972 the proportion of sand and gravel

Table 5.—Maryland: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	4,252	7,170	5,231	10,510
Fill	191	118	133	W
Paving	1,232	2,412	1,343	2,907
Other uses [1]	934	2,210	1	159
Total [2]	6,608	11,911	6,708	13,577
Gravel:				
Building	3,402	6,713	3,706	8,715
Fill	1,090	1,115	428	514
Paving	986	1,588	919	1,918
Other uses [3]	644	1,858	665	1,794
Total [2]	6,122	11,273	5,718	12,941
Government-and-contractor operations:				
Sand: Paving	--	--	11	2
Gravel: Paving	112	16	157	38
Total sand and gravel [2]	12,842	23,201	12,594	26,557

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes ground (1971), unground (1971), and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes miscellaneous and other gravel.

going into the building trades increased from 60% to 71% of the total, and that going into paving increased from 18% to 19%. The sand and gravel going into fill operations decreased from 10% to 4%. All of the sand and gravel produced was transported by truck rather than by rail or by water.

Flooding caused by hurricane Agnes damaged several of Maryland's sand and gravel pits, but all of the damage was repaired by the end of the year.

Stone.—Stone production in Maryland displayed unusual growth in 1972. There was a 22% increase in tonnage to 19,431,000 short tons and a similar increase in value to $41,973,000. Stone was the most valuable mineral product of the State. Baltimore County produced not only the greatest tonnage of stone in the State but also had the highest unit value of all the major counties. Baltimore was followed by Frederick, Montgomery, Cecil, and Carroll Counties, in order of their stone production. There were 53 stone quarries in 11 counties of the State. Nine of the quarries produced dimension stone; 48 produced crushed and broken stone.

Over 60% of all stone produced in Maryland went to aggregates of all kinds; 12.5% went to cement manufacture; nearly 8% went to road base stone, and the remaining 19.5% was utilized in miscellaneous applications such as lime manufacture and riprap stone.

Only 1 ton of dimension stone was produced for each 740 tons of crushed and broken stone, but its average unit value was nearly nine times that of the average for crushed and broken stone.

Of the total stone production 74% was limestone, 12% was traprock, 9% granite, and the remaining 5% was composed of marble, shell, quartzite, sandstone, and other stone.

Several quarries were flooded by hurricane Agnes. Most of them were soon put back into operation, but at least one quarry was abandoned.

Talc and Soapstone.—Talc was mined by one relatively small producer in Harford County in 1972. The pit value of the product averaged $7.14 per ton. It was sold to a firm in New Jersey to make refractories.

Vermiculite (Exfoliated).—One company processed vermiculite in Maryland during 1972. It was the Construction Products division of the W. R. Grace & Co., of Muirkirk, Prince Georges County. About 49% of the vermiculite was used in horticulture, 29% as a concrete aggregate, 20% as loose fill insulation, and the remaining 2% in miscellaneous uses.

MINERAL FUELS

Coal (Bituminous).—Production of bituminous coal in 1972 was 1,640,000 tons, almost identical to that of 1971. The unit value of the coal, however, dropped 12.6%, so the total value of Maryland's coal output was $8,961,000. Allegany County had one underground mine, 17 strip mines, and three auger mines for a total of 21 in the county. Garrett County had four underground mines, 24 strip mines, and six auger mines for a county total of 34 mines. Production-wise, the 41 strip mines of the State produced 87% of the coal; underground mines produced 9%; and the remaining 4% came from auger mines. In 1972 strip mining increased, and deep mining and auger mining decreased.

A most important consideration in the strip mining of coal is reclamation of the land. In Maryland in 1972, 83% of the acreage that was strip mined was back filled and 53% of it was replanted. Among other reclamation projects, and 8,000-foot grass-covered landing strip for light airplanes was constructed over an area that had previously been mined for coal. Much of the back-filled land is more useful after reclamation than before it was strip mined.

Table 6.—Maryland: Coal (bituminous) production in 1972 by county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total[1]	
Allegany	1	17	3	21	7	504	9	520	$2,799
Garrett	4	24	6	34	134	930	55	1,120	6,162
Total	5	41	9	55	141	1,434	64	1,640	8,961

[1] Data may not add to totals shown because of independent rounding.

A State law passed in 1969 has been very effective in regulating strip mining and in promoting the reclamation of strip-mined land.

There were no fatalities in coal mines in 1972, and there were only five lost-time accidents out of 618,000 man-hours of exposure. This gives a frequency rate of 9.61 accidents per million man-hours. There were 328,684 tons of coal mined in 1972 per injury as compared to only 265,280 tons in 1971.[3]

Coke and Coal Chemicals.—Bethlehem Steel Corp. produced coke for its internal use at Sparrows Point, Md. From the volatile material released during coal carbonization, Bethlehem recovered coke-oven gas, ammonia, crude light oil, benzene, toluene, xylene, oven coke tar, and other minor components.

Natural Gas and Petroleum.—There was a 14% increase in the volume of natural gas produced in Maryland in 1972. The monetary value of the gas increased about 19% because of an increase in unit value. All of the gas was produced in the extreme western part of the State.

There were two petroleum refineries near Baltimore. Their combined capacity was 19,000 barrels per day, but none of the feedstock originated in Maryland. The port of Baltimore was reported to have handled over 12 million tons of petroleum in 1972.

The Crown Central Petroleum Corp. was constructing a $200 million plant in Baltimore, which was scheduled to start producing 100,000 cubic feet per day of synthetic natural gas and 70,000 barrels per day of low-sulfur fuel oil by the winter of 1973–74.[4]

Officials of the Department of Commerce are urging the construction of a deep-water super tanker terminal off the east coast of the United States. Residents of Maryland have protested the location of such a port off Assateague Island.

Peat.—Production of peat in Maryland dropped in 1972 to 2,653 short tons valued at $29,260. The peat obtained was humus and reed sedge and was sold in both bulk and packaged form for soil improvement.

METALS

Aluminum.—No bauxite or other aluminum ore was mined in Maryland during the year, but there was a significant production of metallic aluminum from two production facilities in the State. The raw material was shipped into Maryland via water and rail through Hawkins Point, Anne Arundel County. The plants were Estalco Aluminum Co. of Frederick County whose published production capacity was 87,000 tons per year and the Tomke Aluminum Co. of Baltimore County.

The value of aluminum production in 1972 was above the 1971 figure, but the quantity of aluminum produced was almost the same in both years.

Copper.—No copper ore was mined in Maryland in 1972. Two copper refineries produced metal in Maryland, however, using domestic and imported blister copper. They were American Smelting and Refining Co. in Baltimore and Kennecott Refining Corp. of Hawkins Point, Anne Arundel County.

Iron and Steel.—There was no mining of iron ore in Maryland in 1972, but the Bethlehem Steel Corp. at Sparrows Point produced pig iron, raw steel, and semifabricated steel products from imported ore.

Lead.—Lead, lead alloys, and other alloys and products were produced by three plants in Baltimore. The plants utilized primary metals and scrap for raw materials.

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[3] Work cited in footnote 2.

[4] Chemical Engineering. New Plants and Facilities—Petroleum and Natural Gas Products. V. 79, No. 7, Apr. 3, 1972, p. 92.

Table 7.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Portland:			
Alpha Portland Cement Co.	15 South Third St. Easton, Pa. 18042	Plant	Frederick.
Lehigh Portland Cement Co.	718 Hamilton St. Allentown, Pa. 18101	do	Carroll.
Portland and Masonry:			
Marquette Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	do	Washington.
Masonry:			
M. J. Grove Lime Co., Division of the Flintkote Co.	Lime Kiln, Md. 27163	do	Frederick.
Clays:			
Arundel Corp	501 St. Paul Pl. Baltimore, Md. 21202	Pit	Baltimore.
Capitol Clay Products Inc.	6600 Sheriff Rd., N.E. Washington, D.C. 20027	Pit	Prince Georges.
Cyprus Mines Corp	P.O. Box 1201 Trenton, N.J. 08606	Pit	Baltimore.
Victor Cushwa & Sons, Inc	201 West Potomac St. Williamsport, Md. 21795	Pit	Washington.
Lehigh Portland Cement Co.	718 Hamilton St. Allentown, Pa. 18101	2 pits	Carroll.
Maryland Clay Products, Inc. Borden Brick & Tile Co. Div.	7100 Muirkirk Rd. Beltsville, Md. 20705	do	Prince Georges.
Structural Components Corp.	7600 Pulaski Highway Baltimore, Md. 21237	Pit	Baltimore.
Coal:			
Buffalo Coal Co., Inc	P.O. Box 275 Bayard, W. Va. 26707	3 strip; 1 auger	Allegany and Garrett.
Grafton Coal Co	P.O. Box 188 Mountain Lake Park, Md. 21550	Strip	Garrett.
Moran Coal Co., Inc	Drawer E Westernport, Md. 21562	5 strip	Do.
Shallmar Coal Co , Inc	Bayard, W. Va. 26707	1 strip; 1 auger	Do.
TG&C Coal Co., Inc	Midlothian, Md. 21543	Strip	Allegany.
Winner Bros. Coal Co., Inc.	243 Upper Consol Rd. Frostburg, Md. 21532	2 strip	Do.
Gypsum (calcined):			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Plant	Baltimore.
United States Gypsum Co.	101 South Wacker Dr. Chicago, Ill. 60606	do	Do.
Finished iron oxide pigments (natural and manufactured):			
Mineral Pigments Corp	Washington Blvd. Muirkirk, Md. 20705	do	Prince Georges.
Lime:			
S. W. Barrick & Sons, Inc.	Woodsboro, Md. 21798	do	Frederick.
Le Gore Lime Co	Le Gore, Md. 21761	do	Do.
Peat:			
Garrett County Processing & Packaging Corp.	R.F.D. No. 1 Accident, Md. 21520	Bog	Garrett.
Perlite (expanded):			
Atlantic Perlite Co	7950 New Hampshire Ave. Suite 6, Langley Park, Md. 20787	Plant	Prince Georges.
Petroleum refineries:			
American Oil Co	Baltimore, Md. 21200	Refinery	Baltimore.
Chevron Asphalt Co	do	do	Do.
Sand and gravel:			
Annapolis Sand & Gravel Co., Inc.	P.O. Box 322 Waldorf, Md. 20601	Pit	Anne Arundel.
Campbell Sand Co	4911 Calvert Rd. College Park, Md. 20740	Pit	Prince Georges.
Charles County Sand & Gravel Co., Inc.	P.O. Box 322 Waldorf, Md. 20601	Pit	Charles.
Contee Sand & Gravel Co., Inc.	P.O. Box 460 Laurel, Md. 20810	Pit	Prince Georges.
E. L. Gardner	Gambrills, Md. 21054	2 pits	Anne Arundel and Prince Georges.
Inland Materials, Inc	5401 Kirby Rd. Clinton, Md. 20735	Pit	Prince Georges.
Lone Star Industries, Inc.	5001 West Broad St. Richmond, Va. 23226	Pit	Do.
Silver Hill Sand & Gravel Co.	4714 St. Barnabas Rd., S.E. Washington, D.C. 20031	Pit	Do.

Table 7.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
A.H. Smith Co	Branchville, Md. 20721	Pit	Prince Georges.
York Building Products Co., Inc.	P.O. Box 1708 York, Pa. 17400	3 pits	Cecil.
Smelters:			
American Smelting & Refining Co.	120 Broadway New York, N.Y. 10005	Refinery	Baltimore.
Kennecott Copper Corp	161 East 42d St. New York, N.Y. 10017	do	Anne Arundel.
Stone:			
Arundel Corp	501 St. Paul Pl. Baltimore, Md. 21202	Quarries	Baltimore, Harford, Howard.
M. J. Grove Lime Co. Div. of Flintkote Co.	Frederick, Md. 21701	Quarry	Frederick.
Lehigh Portland Cement Co.	718 Hamilton St. Allentown, Pa. 18101	do	Carroll.
Marquette Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	do	Washington.
Martin-Marietta Aggregates Northeast Division.	66 Long Clove Rd. Congers, N.Y. 10920	do	Do.
Maryland Materials, Inc	P.O. Box W North East, Md. 21901	do	Cecil.
Rockville Crushed Stone, Inc.	P.O. Box 407 Rockville, Md. 20850	do	Montgomery.
D. M. Stoltzfus & Sons, Inc.	Talmage, Pa. 17580	do	Cecil and Harford.
Talc and Soapstone:			
Harford Talc Co	P.O. Box 527 Bel Air Md. 21014	do	Harford.
Vermiculite (exfoliated):			
W. R. Grace & Co., Zonolite Division.	62 Whittemore Ave. Cambridge, Mass. 02140	Plant	Prince Georges.

The Mineral Industry of Massachusetts

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Department of Public Works of the Commonwealth of Massachusetts for collecting information on all minerals except fuels.

By Robert A. Clifton [1]

The dollar value of Massachusetts' mineral production in 1972 rose 4% above that of 1971 to $52.4 million. Sand and gravel and stone again dominated the mineral production, with 94% of the value. These commodities together had a 7% increase in quantity and an accompanying 5% increase in value.

This represents a great change from the following 150 year old evaluation:[2]

> "Iron ore, in immense quantities, is found in various parts of the State; but principally in the counties of Plymouth and Bristol. Copper ore is found at Leverett and Attleborough; mines of black lead, at Brimfield; pipe clay, and red and yellow ochre, at Martha's vineyard and other places. In a quarry of limestone, in Newbury, is found the Asbestos, or incombustible cotton. Marble is found in the same vicinity, and also at Lanesborough. In Brookfield, is a large bed of rocks, called pyrites, impregnated with sulphur, vitriol and alum."

The city of Lowell is to have the Nation's first full-scale incinerator residue solid waste recovery plant. A $2.4 million Environmental Protection Agency grant along with State and city money will make the 3-year project feasible.

In July the Department of Commerce Marine Minerals Technology Center started a 4-year study of Massachusetts Bay with an eye toward developing guidelines for hard mineral mining offshore. A critical sand and gravel supply situation in the Boston area helped in the site selection.

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[1] Chemist, Division of Nonmetallic Minerals.

[2] Morse, J., D.D. Geography Made Easy: An abridgement of the American Universal Geography. Thomas & Andrews, Boston, Mass., 18th ed., 1816, p. 129.

Table I.—Mineral production in Massachusetts [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays thousand short tons	186	$377	219	$416
Gem stones	NA	[r] 5	NA	5
Peat thousand short tons	2	32	W	W
Sand and gravel do	17,843	23,058	18,883	25,655
Stone do	7,816	23,582	7,990	23,500
Value of items that cannot be disclosed:				
Nonmetals and values indicated by symbol W	XX	[r] 3,145	XX	2,852
Total	XX	50,199	XX	52,428
Total 1967 constant dollars	XX	42,684	XX	[p] 43,615

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Massachusetts, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Barnstable	$611	W	Sand and gravel.
Berkshire	8,352	$8,946	Stone, lime, sand and gravel.
Bristol	4,560	4,518	Sand and gravel, stone.
Dukes	W	W	Sand and gravel.
Essex	4,353	4,519	Stone, sand and gravel.
Franklin	1,682	1,688	Sand and gravel, stone.
Hampden	3,587	3,645	Do.
Hampshire	W	488	Stone, sand and gravel.
Middlesex	14,709	15,114	Sand and gravel, stone.
Nantucket	W	W	Sand and gravel.
Norfolk	5,499	6,073	Sand and gravel, stone, clays.
Plymouth	1,348	W	Sand and gravel, clays, stone.
Suffolk	666	W	Stone, sand and gravel.
Worchester	4,428	4,750	Sand and gravel, stone, peat.
Undistributed [1]	453	2,693	
Total [2]	50,199	52,428	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes gem stones, some sand and gravel (1972) that cannot be assigned to specific counties, and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Massachusetts business activity

		1971	1972 [p]	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	2,636.3	2,647.8	+0.4
Unemployment	percent of work force	7.0	7.2	+2.9
Employment: (Nonagricultural)				
Manufacturing	thousands	604.3	601.9	−0.4
Construction	do	100.3	99.9	−0.4
Transportation and public utilities	do	118.2	121.5	+2.8
Wholesale and retail trade	do	498.6	498.6	--
Finance, insurance, and real estate	do	129.0	129.1	+0.1
Services [1]	do	474.1	478.5	+0.9
Government	do	330.6	337.2	+2.0
Personal income:				
Total	millions	$26,285	$28,181	+7.2
Per capita		$4,562	$4,870	+6.8
Construction activity:				
Cement shipments to and within Massachusetts	thousand short tons	1,394	1,460	+4.7
Highway construction contracts awarded	millions	$45.4	[e] $50.5	+11.2
Mineral production value	thousands	$50,199	$52,428	+4.4

[e] Estimate. [p] Preliminary.

[1] Includes mining.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Nonmetal	73	270	20	158	--	16	101.07	6,967
Sand and gravel	913	251	229	1,952	--	31	15.88	469
Stone	870	250	218	1,779	--	45	25.29	683
Total	1,856	252	467	3,889	--	92	23.65	831
1972:[1]								
Nonmetal	75	279	21	166	--	14	84.43	3,703
Sand and gravel	630	199	126	1,054	1	18	18.08	6,161
Stone	675	260	176	1,462	--	37	25.30	633
Total	1,380	233	[2] 322	2,682	1	69	26.10	2,995

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabluations were made from data in file as of July 1, 1973 and are preliminary.

[2] Data does not add to total shown because of independent rounding.

The Massachusetts Port Authority plan for an offshore oil terminal remained controversial.

The Attorney General of Massachusetts was turned down by the Supreme Court in his efforts to halt oil exploration on the Georges Bank off Cape Cod. He feels, however, that the suit pending before the U.S. Supreme Court, in which Maine has been joined by Massachusetts, will establish State control over offshore minerals out to 200 miles.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Clays.—Common clay and shale production had a 18% increase in quantity and a corresponding 10% increase in value, but neither volume nor value reached 1970 levels. The leading lightweight aggregates producer was Masslite Co. in Norfolk County. Plymouth County's Stiles and Hart Brick Co. and K-F Brick Co., Inc., had a combined clay-for-brick production that exceeded the total clay production and value of Norfolk County.

Gypsum.—United States Gypsum Co., Suffolk County, manufactured calcined gypsum products. There was an apparent 22% rise in volume from that of 1971.

Lime.—Pfizer, Inc., and Lee Lime Corp. produced lime in Berkshire County for food products, paper and pulp, mason's lime, and other uses. Output decreased 18% and was 37% below the 1969 record. The lime was consumed in Connecticut, Massachusetts, Maine, New York, and other States. Total lime consumption in Massachusetts was 68,840 tons.

Perlite (Expanded).—Crude perlite mined outside the State was expanded at two plants in Suffolk County. The product was sold mainly for lightweight aggregate, low-temperature insulation, masonry and cavity fill insulation, and horticultural aggregate.

Sand and Gravel.—Total sand and gravel production in 1972 was 9% above 1971 volume and 11% above 1971 value. The $25.7 million worth of sand and gravel produced accounted for 49% of the total mineral value in the State, making it the leading mineral commodity produced. Gravel accounted for 55% of the 18.9 million tons of sand and gravel output. Eighty-eight percent of the total tonnage was mined at commercial operations; Government-and-contractor operations produced the balance.

Commercial sand and gravel was produced in all counties in the State except Suffolk, in which production was all noncommercial. Building and paving markets consumed the major portion of the production. Small quantities of sand were used for fill, molding, blast, and filtration. Besides building and paving, gravel was used for railroad ballast and fill.

Stone.—Despite a further reduction in dimension stone production, in 1972 the industry managed to produce 2% more total stone than in 1971; there was little change in value. Dimension stone barely reached 64% of its 1971 production tonnage but received 6% more in value. Crushed and broken stone, however, increased 3% over the 1971 tonnage and had a 2% decrease in overall value. The $23.5 million received kept stone among the top two mineral values in the State and contributed 45% of the State's total mineral value.

Stone, quarried in 11 of the 14 counties, included basalt, granite, limestone, dolomite, and miscellaneous stone. Basalt was the most important stone in both quantity and value. Crushed and broken stone accounted for 99% of the total stone output in 1972.

Crushed basalt was produced in seven counties. Middlesex County led in value and in quantity. The value of crushed basalt accounted for 53% of the total value of stone. The crushed stone was used mainly for construction aggregate; other uses were riprap, railroad ballast, and filter stone.

Granite, sold as crushed and dimension stone, was quarried in four counties. Norfolk County led in value and quantity of granite produced. Granite was the second most important stone produced in the State. The chief use for cut granite was for curbing; other uses were rubble, irregular-shaped stone, paving blocks, cut stone, and house stone veneer. Crushed granite was used mainly for construction aggregate; smaller quantities were used for roadbase stone and railroad ballast.

Limestone was quarried in Berkshire and Middlesex Counties. The chief uses of

Table 5.—Massachusetts: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,145	4,462	3,877	5,813
Fill	567	255	809	485
Paving	2,316	2,787	2,181	2,756
Railroad ballast	--	--	9	14
Other uses[1]	881	1,857	790	1,752
Total[2]	6,909	9,362	7,667	10,818
Gravel:				
Building	3,258	5,883	3,795	7,301
Fill	1,275	947	1,511	975
Paving	2,735	3,555	2,337	3,148
Railroad ballast	W	W	12	31
Miscellaneous	520	660	698	773
Other uses	240	466	547	737
Total[2]	8,029	11,511	8,901	12,964
Government-and-contractor operations:				
Sand:				
Fill	176	38	179	38
Paving	644	386	677	406
Other uses	64	100	48	49
Total[2]	885	524	904	493
Gravel:				
Building	74	184	75	188
Fill	16	16	2	2
Paving	1,428	1,458	1,334	1,189
Other uses	2	5	1	2
Total[2]	1,519	1,662	1,411	1,380
Total sand and gravel[2]	17,343	23,058	18,883	25,655

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes blast, filtration, molding (1972), and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

Table 6.—Massachusetts: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone, total	99	3,782	63	4,016
Crushed and broken stone:				
Bituminous aggregate	2,731	6,460	2,773	5,796
Concrete aggregate	778	1,706	749	1,808
Dense graded road base stone	422	654	1,576	3,382
Macadam aggregate	W	W	142	263
Surface treatment aggregate	61	147	93	205
Unspecified aggregate and roadstone	2,071	4,515	1,290	2,343
Agricultural purposes[1]	W	W	181	984
Filter stone	45	90	W	W
Railroad ballast	93	160	W	246
Riprap and jetty stone	139	W	83	147
Other[2]	1,381	6,068	1,040	4,311
Crushed total[3]	7,717	19,801	7,927	19,485
Grand total[3]	7,816	23,582	7,990	23,500

W Withheld to avoid disclosing individual company confidential data; included with "Other."

[1] Includes agricultural limestone and poultry grit and mineral food.

[2] Data include stone used in lime manufacture, roofing aggregate, asphalt filler, whiting, flux stone, and other uses not specified. Data for 1972 also includes stone used in mine dusting and stone sand.

[3] Data may not add to totals shown because of independent rounding.

crushed limestone, in descending order, were lime, construction aggregate, asphalt filler, whiting, poultry grit, agricultural limestone, other filler, and flux stone.

Crushed miscellaneous stone was quarried in Hampden, Norfolk, and Worcester Counties.

Roofing Granules.—Output of rhyolite to make roofing granules increased slightly. The rhyolite is quarred in Norfolk County; for statistical purposes rhyolite is classified as miscellaneous stone.

Vermiculite.—The quantity and value of the vermiculite processed in Massachusets during 1972 decreased below those of 1971. W. R. Grace & Co. in Hampshire County exfoliated vermiculite mined outside the State. The material was used mainly as insulation; other uses, in order of production, were concrete aggregate, soil conditioning, and plaster.

MINERAL FUELS

Peat.—Reed-sedge peat was mined by Sterling Peat Co. in Worcester County. There was an increase in both tonnage and value over 1971. The peat was used mainly by nurserymen, landscapers, and greenhouse owners.

METALS

Iron and Steel Scrap.—The New England States consumed 355,000 tons of iron and steel scrap and 45,000 tons of pig iron in 1972.

Table 7.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
Susquehanna Corp., K-F Brick Co., Inc.	River St. Middleboro, Mass. 02346	Pit	Plymouth.
Plainville Corp., Masslite Division.	Box 1747 Cross St. Plainville, Mass. 02762	Pit	Norfolk.
Stiles & Hart Brick Co	Box J., Bridgewater, Mass. 02324	Pit	Plymouth.
Gypsum, calcined: United States Gypsum Co	101 S. Wacker Dr. Chicago, Ill. 60606	Plant	Suffolk.
Lime:			
Lee Lime Corp	Marble St., Lee, Mass. 01238	do	Berkshire.
Pfizer, Inc	260 Columbia St. Adams, Mass. 01220	do	Do.
Peat: Sterling Peat Co	Sterling Junction, Mass, 01565	Bog	Worcester.
Perlite, expanded:			
United States Gypsum Co	101 S. Wacker Dr. Chicago, Ill. 60606	Plant	Suffolk.
Whittemore Products, Inc	35 Harrison St. Roslindale, Mass. 02131	do	Do.
Roofing Granules: Bird & Son, Inc	East Walpole, Mass. 02032	do	Norfolk.
Sand and gravel:			
Ashland Sand & Concrete Co	Box 347, Chestnut St. Ashland, Mass. 01721	Pit	Middlesex.
Assonet Sand & Gravel Co., Inc	South Main St. Assonet, Mass. 02702	Pit	Bristol.
Burlington Sand & Gravel Co., Inc.	Blanchard Rd., Box 116 Burlington, Mass. 01803	Pit	Middlesex.
Courtois Sand & Gravel Co	Box 84 Central Falls, R.I. 02863	Pit	Bristol.
J. J. Cronin Co	P.O. Box 176 N. Reading, Mass. 01864	Pit	Middlesex.
E. L. Dauphinais, Inc	160 Worcester Rd. N. Grafton, Mass. 01536	Pit	Middlesex and Worcester.
General Sand & Stone Corp	444 Merrill Rd. Pittsfield, Mass. 01201	Pit	Berkshire.
P. J. Keating Co	P.O. Box 345 Fitchburg, Mass. 01420	Pit	Worcester.
Merrimack Materials, Inc	Yemma Rd. Groveland, Mass. 01830	Pit	Essex.
Morse Sand & Gravel Co	P.O. Box 175 Pawtucket, R.I. 02863	Pit	Bristol.
North Wilbraham Sand & Gravel & Concrete Co., Inc.	2420 Boston Rd. N. Wilbraham, Mass. 01067	Pit	Hampden.
Northfield Washed Sand & Gravel Co., Inc.	Northfield, Mass. 01360	Pit	Franklin.
Pomerleau Bros., Inc	P.O. Box 236 N. Chelmsford, Mass. 01863	Pit	Middlesex.
Thomas Qunn Co., Inc	20 Hobbs Court Arlington, Mass. 02174	Pit	Middlesex and Worcester.
L. Romano Const. Co	835 Taunton Ave. East Providence, R.I. 02914	Pit	Norfolk.

See footnote at end of table.

Table 7.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
Rosenfeld Washed Sand & Stone Co.	40 Cedar St. Milford, Mass. 01757	Pit	Worcester.
San-Vel Contracting Co	Route No. 2, Ayer Rd. Littleton, Mass. 01460	Pit	Middlesex.
Stow Sand & Gravel Co	Box 861, Acton, Mass. 01720	Pit	Do.
Tresca Bros. Sand & Gravel Inc.	66 Main St. Millis, Mass. 02054	Pit	Norfolk.
Varney Bros. Sand & Gravel, Inc.	Hartford Ave. Bellingham. Mass. 02019	Pit	Do.
Warner Bros., Inc	Sunderland, Mass. 01375	Pit	Franklin.
A. A. Will Sand & Gravel Corp.	Turnpike St. Canton, Mass. 02021	Pit	Norfolk.
Worcester Sand & Gravel Co	182 Holden St. Shrewsbury, Mass. 01545	Pit	Worcester.
Wrentham Sand & Gravel Co., Inc.	Riverside Road Wrentham, Mass. 02093	Pit	Norfolk.
Stone:			
B. & M. Crushed Stone, Division Bayer & Mingolla Industries, Inc.	Spring St., Ashland, Mass. 01721	Quarry	Middlesex.
George Brox, Inc	1471 Methuen St. Dracut, Mass. 01826	do	Do.
Essex Bituminous Concrete Corp.	Russel St. West Peabody, Mass. 01960	do	Essex.
Holden Trap Rock Co	N. Main St., Holden, Mass. 01520	do	Worcester.
P. J. Keating Co	P.O. Box 345 Fitchburg, Mass. 01420	do	Do.
John S. Lane & Son, Inc	P.O. Box 125 Westfield, Mass. 01085	do	Hampden and Hampshire.
Lynn Sand & Stone Co	30 Danvers Rd. Swampscott, Mass. 01907	do	Essex.
Massachusetts Broken Stone Co.	Boston Post Road Weston, Mass. 02193	do	Middlesex.
Rowe Contracting Co	1500 Salem St. Malden, Mass. 02148	do	Do.
Simeone Stone Corp	P.O. Box 218 Wrentham, Mass. 02093	do	Norfolk.
Trimount Bituminous Products Co.	1840 Parkway St. Everett, Mass. 02149	do	Essex.
Warner Bros., Inc	Sunderland, Mass. 01375	do	Franklin.
Old Colony Crushed Stone Co	P.O. Box 230 Quincy, Mass. 02169	do	Norfolk.
West Roxbury Crushed Stone Co.	10 Grove St. West Roxbury, Mass. 02132	do	Suffolk.
Lee Lime Corp	Marble St., Lee, Mass. 01238	do [1]	Berkshire.
Pfizer, Inc	260 Columbia St. Adams, Mass. 01220	do	Do.
Dedham Sand & Gravel, Inc	Walpole, Mass. 02081	do	Norfolk.
S. M. Lorusso & Sons, Inc	331 West St. Walpole, Mass. 02081	do	Do.
Warren Bros. Co., Division of Ashland Oil & Refining Co.	430 Howard St. Brockton, Mass. 02402	do	Bristol.
Vermiculite, exfoliated:			
W. R. Grace & Co., Zonolite Div.	62 Whittemore Ave. Cambridge, Mass. 02140	Plant	Hampshire.

[1] 2 quarries; 1 dolomite, 1 limestone.

The Mineral Industry of Michigan

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey Division of the Michigan Department of Natural Resources, under a memorandum of understanding for collecting information on all minerals except coal and liquid fuels.

By Grace N. Broderick [1]

In 1972 the mineral production of Michigan was valued at $694.8 million, an increase of 8.4% over the $640.6 million reported for 1971 and a 3.6% gain over the previous record high of $670.7 million set in 1970. Iron ore continued to be the leading mineral commodity in terms of value, followed by cement, copper, and sand and gravel.

Nonmetallic minerals as a group retained dominance of the State's overall total mineral value, contributing 56%. Within this group, cement led in value, followed by sand and gravel, salt, stone, and magnesium compounds. Nationally, Michigan ranked first in production and value of gypsum production. It was the only domestic producer of iodine, and ranked second to Arkansas in bromine production, and second to California in production of sand and gravel. Other nonmetallic minerals produced were clays, gem stones, lime, and calcium-magnesium chloride.

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[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Michigan [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland ... thousand short tons	6,108	$104,665	5,901	$111,410
Masonry ... do	239	5,872	250	5,959
Clays ... do	2,458	3,366	2,514	3,715
Copper (recoverable content of ores, etc.) ... short tons	56,005	58,245	67,260	68,874
Gem stones	NA	8	NA	8
Gypsum ... thousand short tons	1,433	5,585	1,650	7,267
Iron ore (usable) ... thousand long tons, gross weight	11,833	159,854	12,692	177,461
Lime ... thousand short tons	1,444	20,549	1,509	22,753
Magnesium compounds short tons, MgO equivalent	272,918	27,777	377,675	31,484
Natural gas ... million cubic feet	25,662	6,776	34,221	10,506
Natural gas liquids:				
Natural gasoline ... thousand 42-gallon barrels	553	1,518	395	1,097
LP gases ... do	975	2,623	833	2,274
Peat ... thousand short tons	202	2,497	219	2,190
Petroleum (crude) ... thousand 42-gallon barrels	11,893	38,859	12,990	41,556
Salt ... thousand short tons	4,458	49,007	4,358	50,761
Sand and gravel ... do	56,613	62,898	59,467	65,445
Silver (recoverable content of ores, etc.) thousand troy ounces	670	1,036	785	1,323
Stone ... thousand short tons	40,705	49,240	39,754	50,317
Value of items that cannot be disclosed:				
Bromine, calcium-magnesium chloride, iodine	XX	40,266	XX	40,367
Total	XX	640,636	XX	694,767
Total 1967 constant dollars	XX	544,733	XX	[p] 577,976

[p] Preliminary. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Michigan, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Alcona	[r] $185	$49	Sand and gravel.
Alger	69	52	Do.
Allegan	924	999	Sand and gravel, petroleum, natural gas, peat, stone.
Alpena	W	49,296	Cement, stone, clays, sand and gravel.
Antrim	W	W	Sand and gravel, clays, petroleum.
Arenac	[r] 1,254	1,195	Petroleum, stone, sand and gravel.
Baraga	81	W	Sand and gravel.
Barry	W	W	Sand and gravel, petroleum, stone.
Bay	10,805	11,796	Cement, sand and gravel, petroleum, lime.
Benzie	18	W	Sand and gravel.
Berrien	W	8,088	Sand and gravel, stone.
Branch	W	W	Do.
Calhoun	5,061	5,546	Petroleum, natural gas, sand and gravel, stone.
Cass	W	W	Sand and gravel, stone.
Charlevoix	W	W	Cement, stone, sand and gravel.
Cheboygan	W	W	Stone, sand and gravel.
Chippewa	3,618	W	Do.
Clare	1,331	1,390	Petroleum, sand and gravel, natural gas.
Clinton	807	616	Sand and gravel, clays.
Crawford	W	W	Petroleum, natural gas, sand and gravel.
Delta	W	W	Sand and gravel, stone.
Dickinson	26,210	31,998	Iron ore, sand and gravel, stone.
Eaton	729	735	Stone, sand and gravel, clays, petroleum, peat.
Emmet	12,882	12,299	Cement, stone, clays, sand and gravel.
Genesee	975	700	Sand and gravel, petroleum.
Gladwin	912	875	Petroleum.
Gogebic	W	26	Sand and gravel.
Grand Traverse	W	620	Natural gas, petroleum, sand and gravel.
Gratiot [1]	W	6,596	Magnesium compounds, salt, calcium-magnesium chloride, sand and gravel, petroleum, natural gas, bromine.
Hillsdale	W	10,085	Petroleum, natural gas liquids, natural gas, sand and gravel, stone.
Houghton	W	296	Sand and gravel, stone, copper.
Huron	1,276	1,202	Stone, sand and gravel, lime, petroleum.
Ingham	1,917	5,548	Petroleum, natural gas, sand and gravel, natural gas liquids, peat.
Ionia	319	W	Sand and gravel.
Iosco	5,806	6,775	Gypsum, sand and gravel.
Iron	6,635	W	Iron ore, sand and gravel.
Isabella	W	649	Petroleum, sand and gravel.
Jackson	2,921	3,289	Petroleum, natural gas, sand and gravel, stone.
Kalamazoo	W	W	Sand and gravel, stone.
Kalkaska	[2] 1,007	W	Petroleum, natural gas, sand and gravel.
Kent	5,106	5,497	Sand and gravel, gypsum, petroleum, peat, natural gas, stone.
Keweenaw	5	2	Sand and gravel.
Lake	680	483	Petroleum, sand and gravel.
Lapeer	1,231	1,812	Peat, sand and gravel, petroleum, calcium-magnesium chloride, natural gas.
Leelanau	609	W	Sand and gravel.
Lenawee	1,002	1,335	Sand and gravel, clays, natural gas.
Livingston	2,936	W	Sand and gravel.
Luce	W	W	Do.
Mackinac	W	W	Stone, sand and gravel.
Macomb	2,267	W	Sand and gravel, natural gas, petroleum.
Manistee	26,701	29,258	Magnesium compounds, salt, sand and gravel, bromine.
Marquette	128,064	142,951	Iron ore, sand and gravel, stone.
Mason	26,747	30,251	Magnesium compounds, calcium-magnesium chloride, lime, bromine, sand and gravel, petroleum.
Mecosta	W	393	Sand and gravel, petroleum, natural gas, peat.
Menominee	W	W	Lime, sand and gravel.
Midland	W	30,937	Bromine, calcium-magnesium chloride, magnesium compounds, salt, iodine, petroleum, sand and gravel.
Missaukee	W	2,167	Petroleum, natural gas, sand and gravel.
Monroe	W	24,352	Cement, stone, clays, peat, petroleum.
Montcalm	W	568	Petroleum, sand and gravel.
Montmorency	2	27	Sand and gravel.
Muskegon	W	2,646	Sand and gravel, salt, petroleum.
Newaygo [2]	W	132	Sand and gravel, petroleum, natural gas.
Oakland	18,543	W	Sand and gravel, peat, petroleum.
Oceana	401	385	Sand and gravel, petroleum.
Ogemaw	1,628	2,275	Petroleum, sand and gravel, natural gas.
Ontonagon	59,282	70,444	Copper, silver, stone, sand and gravel.
Osceola	W	2,616	Petroleum, natural gas liquids, sand and gravel, natural gas.
Oscoda	40	10	Sand and gravel, petroleum.
Otsego	W	W	Petroleum, natural gas, sand and gravel.
Ottawa	3,763	4,379	Sand and gravel, clays, petroleum, natural gas.

See footnotes at end of table.

Table 2.—Value of mineral production in Michigan, by county—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Presque Isle	W	$21,528	Stone, sand and gravel, petroleum.
Roscommon	W	1,255	Petroleum, sand and gravel, natural gas.
Saginaw	$809	766	Sand and gravel, lime, clays, petroleum.
St. Clair	18,923	26,669	Salt, cement, petroleum, natural gas, natural gas liquids, clays, sand and gravel.
St. Joseph	198	269	Sand and gravel, stone, peat.
Sanilac	1,935	1,546	Peat, sand and gravel, lime.
Schoolcraft	W	W	Stone, sand and gravel.
Shiawassee	486	764	Sand and gravel, peat, clays, petroleum.
Tuscola	W	W	Sand and gravel, petroleum, lime.
Van Buren	133	158	Sand and gravel, petroleum.
Washtenaw	2,508	W	Sand and gravel, natural gas liquids, petroleum.
Wayne	54,028	61,212	Cement, lime, salt, sand and gravel, stone, clays, petroleum.
Wexford	W	W	Sand and gravel, petroleum.
Undistributed	[3] 202,467	[4] 72,008	
Total	640,636	[5] 694,767	

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Excludes value of bromine.

[2] Excludes value of natural gas.

[3] Includes values for natural gas, natural gas liquids, gem stones, some sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.

[4] Includes gem stones, some sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.

[5] Data does not add to total shown because of independent rounding.

Table 3.—Indicators of Michigan business activity

		1971	1972 [p]	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	3,621.0	3,665.0	+1.2
Unemployment	do	295.4	302.7	+2.5
Employment:				
Manufacturing	do	1,045.0	1,067.3	+2.1
Contract construction	do	111.9	108.5	−3.0
Mining	do	11.4	11.8	+3.5
Transportation and public utilities	do	148.3	145.1	−2.2
Wholesale and retail trade	do	608.0	609.9	+.3
Finance, insurance, and real estate	do	116.3	118.7	+2.1
Services	do	431.5	441.7	+2.4
Government	do	504.9	520.6	+3.1
Personal income:				
Total	millions	$39,850	$43,746	+9.8
Per capita		$4,430	$4,817	+8.7
Construction activity:				
Valuation of nonresidential construction	millions	$514.0	$586.7	+14.1
Number of private and public residential units authorized		72,848	71,218	−2.2
State highway department: Contracts awarded	millions	$253.5	[e] $248.8	−1.9
Portland cement shipments to and within Michigan	thousand short tons	3,349	3,231	−3.5
Farm marketing receipts	millions	$1,021.7	$1,102.0	+7.9
Mineral production value	do	$640.6	$694.8	+8.5

[e] Estimated. [p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Metallic minerals represented 36% of the total value of mineral production in 1972. Iron ore shipments were 12.7 million long tons compared with 11.8 million long tons in 1971, an increase of 7.3%. Production of 67,260 short tons of copper, in terms of recoverable metal, was 20.1% more than in 1971, when a lengthy strike at the White Pine operation curtailed production. Silver was recovered from copper ore at the White Pine mine.

Mineral fuels (natural gas, natural gas liquids, peat, and petroleum) provided 8% of the total value of mineral output. Michigan's oil and gas production is a relatively small part of total U.S. production, but over the years it has contributed significantly to the State's mineral industry.

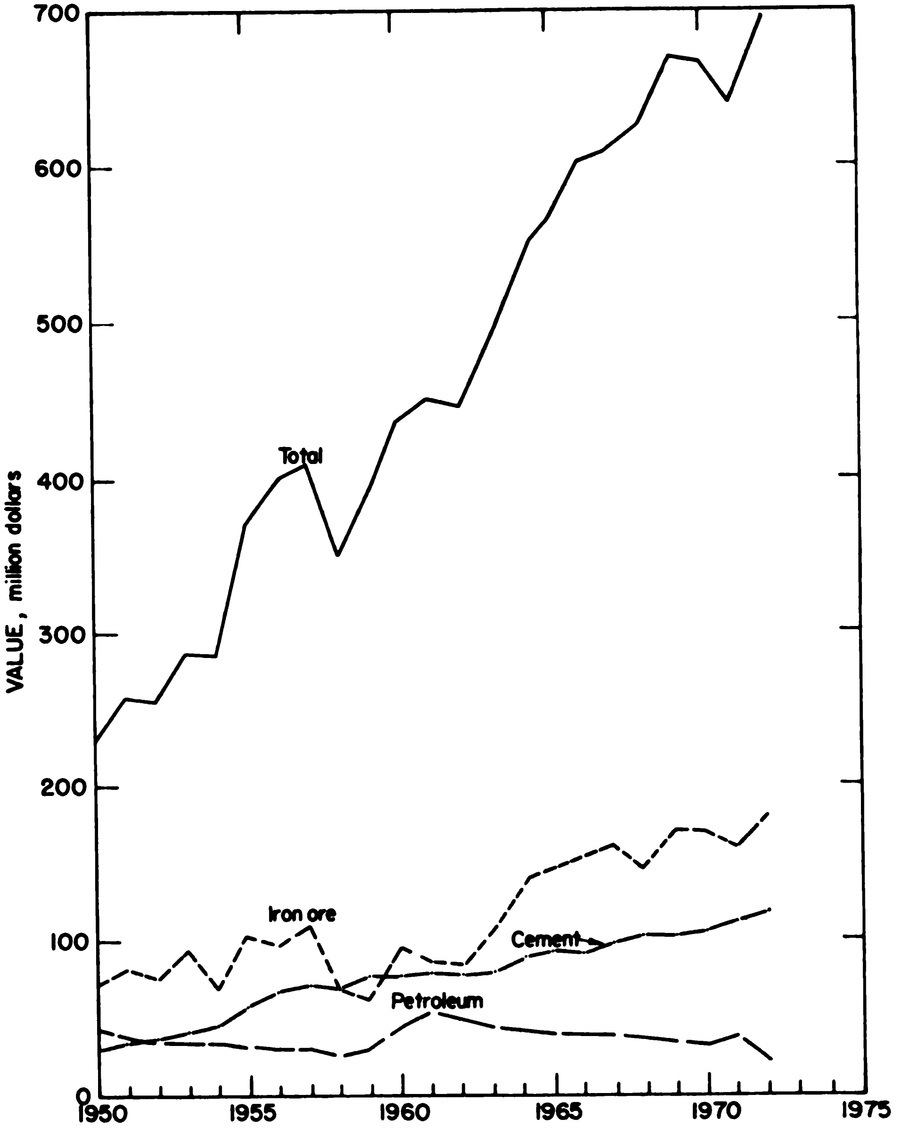

Figure 1.—Value of iron ore, petroleum, cement, and total value of mineral production in Michigan.

Value of oil production in Michigan in 1972 was $41.6 million, an increase of nearly 7% over that of 1971. Gas production value increased 55% from $6.8 million to $10.5 million. Michigan continued as the principal producer of peat in the United States, accounting for 36% of the U.S. total. Peat was sold principally for soil improvement; none was sold as a fuel.

The dismantling of the Enrico Fermi plant, the world's first and largest nuclear breeder reactor, has begun. Located on Lake Erie, near Monroe, this experimental facility is being abandoned because its nuclear core, or basic fuel supply, was worn and the 22-company consortium (Power

Reactor Development Co.) supporting the project declined to contribute the $35 million to purchase a new one. The plant, built in 1963 at a cost of $133 million, produced only 378 hours of power in its 9-year existence. The nuclear core, which belongs to the Atomic Energy Commission (AEC), has to be removed from the nuclear reactor and returned to the AEC's Savannah River plant at Aiken, S.C.

A summary compiled by the Locks Operation Office at the Soo Locks, Saulte Ste. Marie, showed that about 7% of all the iron ore from Lake Superior going through the locks was carried by the three largest freighters on the Great Lakes. Out of a total of 61,736,615 net tons of iron ore going through the locks, the *Steward J. Cort, Roger Blough,* and *Charles M. Beeghly* had carried 4,354,490 net tons of taconite pellets as of December 10, 1972.

The Locks Operation Office reported there are 131 U.S. and 92 Canadian flat-deck bulk carriers hauling bulk cargo on the Great Lakes, and 46 U.S. and 27 Canadian self-unloading bulk carriers. The flat-deck carriers chiefly transport iron ore and grain; the self-unloaders mainly carry iron ore and stone, plus some coal and other bulk cargo.

Legislation.—Michigan amended its 1970 Mine Reclamation Act (Act 92 of the Public Acts of 1970) by Act 123 of the Public Acts of 1972. The amended act extends the coverage of lands subjected to the mining of minerals from that of the earlier act, which included only lands subjected to the mining of metallic minerals. According to Act 123, "mineral" means coal, gypsum, stone, metallic ore or material mined for its metallic content and other similar solid material or substance to be excavated from natural deposits on or in the earth for commercial, industrial, or construction uses but does not include clay, gravel, marl, peat, or sand.

Employment.—Preliminary data for 1972 and final data for 1971 compiled by the U.S. Bureau of Mines on employment and injuries in the mineral industry, excluding the petroleum industry, are shown in table 4.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	4,018	311	1,247	9,976	--	251	25.16	1,517
Nonmetal	908	247	224	1,855	--	52	28.04	561
Sand and gravel	2,471	225	555	4,786	1	125	26.33	3,178
Stone	3,091	275	850	7,001	1	82	11.86	1,238
Total [1]	10,483	274	2,877	23,617	2	510	21.68	1,696
1972: [2]								
Metal	3,975	336	1,334	10,672	4	263	25.02	2,863
Nonmetal	780	240	186	1,552	--	38	24.49	527
Sand and gravel	1,350	207	279	2,450	2	53	22.45	9,127
Stone	1,980	258	510	4,288	1	31	7.46	1,730
Total [1]	8,085	286	2,310	18,961	7	385	20.67	3,225

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives, Manufactured.—Metallic abrasive producers in 1972 were Abrasive Materials, Inc., at its Hillsdale plant, Hillsdale County; Cleveland Metal Abrasive Co., at its Howell plant, Livingston County; and Ervin Industries, Inc., at its Adrian plant, Lenawee County. The State ranked second to Ohio in the manufacture of metallic abrasives.

Bromine.—Bromine was recovered from well brines by The Dow Chemical Co. at its Ludington and Midland plants in Mason and Midland Counties, respectively;

by Morton Chemical Co. at its Manistee plant, Manistee County; and by the Michigan Chemical Corp. at its St. Louis plant in Gratiot County. Output decreased 6.6% in quantity and 4.3% in value from 1971 figures.

Calcium-Magnesium Chloride.—Michigan Chemical Corp., Wilkinson Chemical Corp., and The Dow Chemical Co. recovered calcium-magnesium chloride from brine wells in Gratiot, Lapeer, Mason, and Midland Counties. Output decreased 3% in quantity but increased 6% in value.

Cement.—Portland cement shipments decreased 3.4%, but value of shipments increased 6.4%. Counties producing portland cement were Alpena, Bay, Charlevoix, Emmet, Monroe, St. Clair, and Wayne. Average mill value of portland cement increased to $18.88 per ton from $17.14 per ton in 1971. Yearend stocks of portland cement at mills were 763,454 tons compared with 619,748 tons in 1971. More than 93% of the portland cement shipped was Type I and II (general use and moderate heat); the remainder was principally Type III (high-early-strength). Consumption of portland cement in Michigan totaled 3,231,389 tons. It was consumed by ready-mix concrete companies (64%), concrete product manufacturers (16%), building material dealers (7%), and contractors and other users (13%).

Masonry cement shipments increased 4.8%, but value rose only 1.5%. Masonry cement was produced in Alpena, Bay, Emmet, and Wayne Counties. Average mill value of masonry cement was $23.82 per ton compared with $24.61 per ton in 1971. Yearend stocks of masonry cement at mills were 61,709 tons compared with 49,499 tons in 1971. Masonry cement consumed in the State totaled 179,968 tons.

In 1972, Michigan continued to hold fourth place in the shipment of cement, being outranked only by California, Pennsylvania, and Texas, respectively in first, second, and third place. The leading producers in Michigan were Huron Cement Division of the National Gypsum Co., Peerless Cement Division of American Cement Corp., and Dundee Cement Co.

Peerless Cement Division closed its Port Huron plant at yearend. In October, Peerless suspended manufacturing operations at its Brennan Avenue plant in Detroit. Future plans are to incorporate the 16-year-old facility into the firm's new Detroit plant complex. Peerless' old Jefferson Avenue plant, purchased by Detroit Edison Co., was sold in June 1972 to Edward C. Levy Co. Doing business under the name Jefferson Marine Terminal, the firm produced cement by grinding clinker imported from Sweden and Canada.

The Medusa Portland Cement Co., known as such since 1916, changed its name on April 1, 1972, to Medusa Corp. The company was founded 80 years ago as the Sandusky Portland Cement Co. To permit the company's plant at Charlevoix to operate a longer season, clinker storage was built. Bag packing facilities have been added at Detroit to tap the market for masonry and package gray cement.

At the Dundee Cement Co.'s Dundee plant, four Koppers electrostatic precipitators were installed.

Huron Cement Division of National Gypsum Co. neared completion of a $2.5 million air pollution control program at its Alpena plant. A corporate computer and communications center was established at Southfield.

Table 5.—Michigan: Portland cement statistics

(Short tons)

	1971	1972
Number of active plants	9	9
Production	6,015,096	6,180,940
Shipments from mills:		
Quantity	6,108,020	5,901,390
Value	$104,665,357	$111,409,545
Stocks at mills, Dec. 31	619,020	763,454

Table 6.—Michigan: Masonry cement statistics

(Short tons)

	1971	1972
Number of active plants	4	5
Production	228,391	259,212
Shipments from mills:		
Quantity	238,597	250,161
Value	$5,872,083	$5,958,549
Stocks at mills, Dec. 31	49,499	61,709

Clays.—Miscellaneous clays and shale were mined at 15 pits in 12 counties. Output of clay and shale increased 2.3% in quantity and 10.4% in value over that of 1971. Eighty-one percent of the clay or shale was used in cement manufacture in

1972, as compared with 78% used for this purpose in 1971. Other uses were for lightweight aggregate and heavy clay products. The largest production was reported from Alpena, Wayne, Monroe, Ottawa, Emmet, St. Clair, and Saginaw Counties.

Gem Stones.—Semiprecious stones and mineral specimens continued to be collected. The State legislature passed a bill making chlorastrolite the official State gem.

Gypsum.—Michigan ranked first in the United States in quantity and value of crude gypsum produced in 1972. Production increased 15% to a record 1,650,000 tons, valued at $7.3 million. The gypsum was produced from open pit mines in Iosco County by U.S. Gypsum Co., National Gypsum Co., and Michigan Gypsum Co., and from underground mines in Kent County by Georgia-Pacific Corp. and Grand Rapids Gypsum Co. Calcined gypsum, output of which increased 44% to a record 536,400 tons, was produced in Iosco County by National Gypsum Co., in Kent County by Georgia-Pacific Corp. and Grand Rapids Gypsum Co., and in Wayne County by U.S. Gypsum Co.

Georgia-Pacific Corp., in 1971, closed its Grand Rapids mine under the Butterworth Road plant and opened a new underground mine (the Kentwood mine at 3900 East Paris Avenue in Grand Rapids). Ore from the Kentwood mine is crushed underground and then transported to the Butterworth Road plant for processing.

Iodine.—The sole domestic producer, The Dow Chemical Co., continued to recover crude iodine from natural well brines at Midland. Production increased 2.9% over that of 1971, while value increased by 11.7%.

Lime.—Seven companies produced lime at 10 plants in 8 counties. Leading companies were BASF Wyandotte Corp., Marblehead Lime Co., Detroit Lime Co., and The Dow Chemical Co. C. Reiss Coal Co., located in Menominee County, closed down its operation in June. Output of lime increased 4.5% in quantity and 10.7% in value over that of the previous year. Plants in Wayne County produced 78% of the State total. Most of the State's production was quicklime, but a small tonnage of hydrated lime was manufactured. The lime was used for steel furnaces, alkalies, water purification, and other uses. Fifty percent of the output was used by producers, and the other 50% was sold. Only 3% was shipped to consumers outside the State, mostly in Ohio but also in Wisconsin, Indiana, and Pennsylvania. Total consumption of lime in Michigan was 1,654,096 tons.

Magnesium Compounds.—Michigan continued as the Nation's largest producer of magnesium compounds, accounting for nearly 52% of the U.S. total. Production increased 38.4% in quantity and 13.3% in value over the 1971 figures. Output came from Gratiot, Manistee, Mason, and Midland Counties.

Perlite.—Crude perlite, mined in the Western States, was expanded by National Gypsum Co. at its National City plant, Iosco County, by U.S. Gypsum Co. at its River Rouge plant, Wayne County, and by Harborlite Corp. at its Vicksburg plant, Kalamazoo County; Georgia-Pacific Corp. discontinued expanding perlite at its Grand Rapids plant in Kent County. Most of the expanded perlite was used for plaster aggregate.

Salt.—Salt was produced from one rock salt mine in Wayne County, the only underground salt mine in the State, and from natural and artificial brines at plants in Gratiot, Manistee, Midland, Muskegon, St. Clair, and Wayne Counties. Output was 2.2% less than that in 1971 and value 3.6% more.

Sand and Gravel.—Michigan ranked second only to California in production of sand and gravel in the United States. Tonnage increased 5% and was valued at $65.4 million, an increase of 4% over the 1971 value. Nearly every county in Michigan reported sand and gravel production. In each of 10 counties, output exceeded 1 million tons. These counties provided almost 55% of the State production. Five of these counties make up metropolitan Detroit and produced over 23 million tons. About 92% of the sand and gravel was moved by truck, and the remainder was shipped by rail or water. Production was reported from 329 commercial and 66 Government-and-contractor operations.

Stone.—Michigan, with production of 39.8 million tons, ranked eighth in the Nation's output of stone. Production (principally crushed limestone and dolomite) decreased 2.3% from that of 1971. Ninety-three percent of the production was

Table 7.—Michigan: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	8,568	7,952	7,862	7,571
Engine	39	104	28	73
Fill	3,184	1,619	2,610	1,634
Molding	3,435	7,063	2,909	6,694
Paving	6,773	6,610	8,772	8,960
Other uses [1]	1,406	3,608	2,363	4,534
Total [2]	23,405	26,954	24,544	29,465
Gravel:				
Building	6,359	10,596	7,344	11,037
Fill	463	263	288	283
Paving	19,103	19,098	17,942	19,204
Railroad ballast	19	35	W	W
Miscellaneous	1,206	1,476	1,716	1,464
Other uses	799	624	2,849	2,191
Total [2]	27,950	32,092	30,139	34,181
Government-and-contractor operations:				
Sand:				
Building	34	3	4	1
Fill	1,091	303	849	92
Paving	886	461	700	213
Other uses	183	79	109	69
Total [2]	2,195	846	1,662	375
Gravel:				
Building	163	145	127	90
Fill	248	92	420	26
Paving	2,650	2,768	2,508	1,290
Other uses	1	(3)	68	18
Total [2]	3,062	3,005	3,122	1,424
Total sand and gravel [2]	56,613	62,898	59,467	65,445

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes abrasives, railroad ballast (1971), blast, enamel, foundry, glass, fire or furnace (1972), grinding and polishing, pottery, and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Less than ½ unit.

reported from seven counties: Alpena, Chippewa, Mackinac, Monroe, Presque Isle, Schoolcraft, and Wayne.

A large proportion of the material was shipped by boat from company-operated ports on Lakes Huron and Michigan to steel mills, cement and lime plants, and other consumers. In table 10, the distribution of crushed and broken stone shipments by type of use is shown.

The world's largest limestone quarry, the Calcite quarry, is located near Rogers City in Presque Isle County. Since 1911, when Michigan Limestone and Chemical Co. first opened the quarry, about 600 million tons of stone have been removed. The operation, which now stretches roughly 18,000 acres along the shore of Lake Huron, was purchased by United States Steel Corp. in 1920 to meet its own needs for metallurgical stone, but the emergence of other uses for the high-calcium limestone attracted a growing list of commercial customers. A three-phase project to rehabilitate and modernize the original Calcite facilities, started at the close of the lake-shipping season during the winter of 1967–68, was completed in April 1971. The project, in addition to including equipment needed to produce the greater quantities of small-size limestone pellets required by the steel industry, boosted efficiency of the stone-processing systems and provided the opportunity to rearrange product stockpiling systems for a better balance of recovery and loadout operations. Average annual output is several millions of tons and involves eight basic sizes of stone, ranging from 8 by 5½ inches to 4-mesh by 0 fines.[2]

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[2] Pit and Quarry. V. 65, No. 2, August 1972, pp. 76–85.

Table 8.—Michigan: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alcona	2	272	185	2	86	49
Alger	1	85	69	1	99	52
Allegan	7	755	497	5	902	542
Antrim	1	84	78	2	84	158
Baraga	2	168	81	2	W	W
Barry	7	582	707	5	387	485
Benzie	1	18	18	1	W	W
Berrien	7	1,438	2,558	12	1,483	W
Branch	2	W	W	3	249	W
Cass	6	349	319	7	322	238
Charlevoix	6	66	50	4	39	21
Cheboygan	2	W	W	4	91	82
Clare	3	82	44	3	W	W
Clinton	8	764	783	11	499	596
Crawford	1	W	W	1	48	28
Dickinson	2	W	W	3	W	186
Eaton	10	652	512	8	281	293
Emmet	2	74	55	3	225	148
Genesee	9	816	758	6	558	552
Gogebic	3	W	W	2	77	26
Grand Traverse	2	W	W	4	W	111
Gratiot	6	293	262	3	238	281
Hillsdale	4	107	56	5	W	W
Huron	4	W	W	6	301	191
Ingham	8	774	778	10	626	W
Ionia	3	338	319	3	294	W
Iron	3	W	W	2	158	159
Isabella	1	W	W	3	309	188
Jackson	2	W	W	4	350	262
Kalamazoo	11	1,003	1,459	6	836	1,244
Kalkaska	1	22	20	1	22	14
Kent	19	2,525	3,968	20	2,761	4,101
Keweenaw	1	16	5	1	17	2
Lake	1	40	22	2	49	44
Lapeer	4	328	187	9	879	558
Lenawee	11	810	996	7	1,099	1,828
Livingston	6	2,576	2,936	6	2,798	W
Mackinac	5	W	W	7	188	72
Macomb	10	2,147	2,254	11	3,017	2,964
Manistee	4	W	W	4	399	W
Marquette	9	545	577	8	1,031	817
Mecosta	2	161	126	2	W	189
Menominee	3	95	90	5	127	114
Montcalm	3	W	W	8	430	226
Montmorency	1	49	2	1	69	27
Muskegon	4	461	1,095	5	W	W
Newaygo	4	W	W	6	185	92
Oakland	24	11,274	13,494	25	12,439	14,198
Oceana	2	271	159	4	257	221
Ogemaw	5	W	W	3	488	W
Ontonagon	1	84	1	1	W	W
Oscoda	1	63	33	1	7	5
Otsego	2	W	W	3	74	49
Ottawa	16	2,875	3,188	12	3,229	3,852
Saginaw	2	W	W	3	367	W
Schoolcraft	--	--	--	1	62	3
Shiawassee	5	289	239	9	520	514
Tuscola	3	712	953	9	795	1,004
Van Buren	3	155	122	4	216	138
Washtenaw	9	2,188	2,487	8	1,816	2,285
Wayne	8	2,769	4,600	8	3,000	5,028
Various [1]	25	8,934	7,544	9	6,441	4,794
Undistributed [2]	[r]68	8,502	8,272	61	8,157	17,019
Total [3]	388	56,618	62,898	395	59,467	65,445

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes production for which no county breakdown is available.

[2] Includes Alpena, Arenac, Bay, Calhoun, Chippewa, Delta, Houghton, Iosco, Leelanau, Luce, Mason, Midland, Missaukee, Monroe (1971), Osceola, Presque Isle, Roscommon, St. Clair, St. Joseph, Sanilac and Wexford Counties.

[3] Data may not add to totals shown because of independent rounding.

Small quantities of dimension stone have been produced in recent years for building purposes. Output in 1972 was 3,802 short tons valued at $66,165.

Ottawa Silica Co., Michigan Division, continued to mine a high-purity quartzite sandstone at Rockwood, Wayne County. The deposit is the Sylvania Sandstone of the Detroit River Group. Silica sand has been mined at the Rockwood site since 1904. The operation was purchased in 1944 by the Ottawa Silica Co. Several thousand tons of high-quality silica is shipped annually from the nearly 700-acre site.[3]

The State of Michigan remained the leading producer of marl with production reported from nine counties. It was sold for agricultural purposes. The bulk of the material came from Allegan, Barry, Cass, Calhoun, and Kalamazoo Counties.

Table 9.—Michigan: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension [1]	1	26	4	66
Crushed and broken:				
Limestone	32,229	35,077	31,301	35,360
Dolomite	7,275	11,267	7,499	12,104
Marl	119	111	79	81
Traprock	9	14	W	W
Other [2]	1,072	2,745	870	2,707
Total [3]	40,704	49,214	39,750	50,251
Grand total	40,705	49,240	39,754	50,317

W Withheld to avoid disclosing individual company confidential data; included with "Other."

[1] Includes limestone and dolomite. 1972 data also include sandstone.

[2] Includes granite, sandstone, quartz (1971), marble (1972) and miscellaneous stone.

[3] Data may not add to totals shown because of independent rounding.

Table 10.—Michigan: Crushed and broken stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Bituminous aggregate	786	921	W	1,218
Concrete aggregate	3,048	3,261	3,241	4,022
Dense graded road base stone	805	954	687	1,065
Surface treatment aggregate	342	494	W	181
Unspecified aggregate and roadstone	3,676	5,491	1,555	2,034
Agricultural limestone	495	529	468	566
Cement manufacture	8,637	7,250	7,184	6,428
Flux	10,740	14,392	11,446	15,944
Lime manufacture	7,345	8,117	9,604	10,926
Other soil conditioners	69	65	88	85
Riprap and jetty stone	595	696	358	629
Terrazzo	3	65	4	109
Other uses [1]	4,212	6,980	5,121	7,051
Total [2]	40,704	49,214	39,750	50,251

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes chemical stone for alkali works, paper manufacture, poultry grit and mineral food, macadam aggregate, stone sand, railroad ballast, drain fields (1971), fill (1972), and unspecified uses.

[2] Data may not add to totals shown because of independent rounding.

Sulfur.—Byproduct sulfur was recovered from crude petroleum by Total Leonard, Inc. (Alma), Marathon Oil Co. (Detroit), and Mobil Oil Co., Inc. (Woodhaven). The latter facility discontinued refining operations at yearend. Shipments remained about the same as in 1971, but value declined by over 24%.

Vermiculite.—Crude vermiculite, mined outside the State, was exfoliated at a plant in the Detroit area. It was sold for use in loose fill insulation, horticulture, concrete aggregate, plaster aggregate, and other uses.

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[3] Michigan Challenge. V. 11, No. 7, June–July 1971, pp. 29–30.

METALS

Copper.—Production of copper, in terms of recoverable metal, was 20.1% more than in 1971 and its value was 18.2% higher; a lengthy strike had curtailed production in 1971. In addition to continued production from the White Pine mine of White Pine Copper Co., in Ontonagon County, a small amount of copper was produced by Mineral Recovery Corp. from tailings at the Champion mine in Houghton County.

The White Pine Copper Co., a subsidiary of the Copper Range Co., produces copper from sulfides mineralization in the Nonesuch Shale. Ore from the underground mine is extracted by the room-and-pillar system, using trackless equipment. Ore is moved from the working faces in 18-ton-capacity Wagner ore cars to pockets which are 1,200 feet or less from the face. Crushers are used at certain locations to reduce the ore before transporting it from the mine.

The concentrator employs rod mills followed by ball mills for grinding. Two flotation circuits are operated. One makes a copper concentrate which is high in silver. The company smelts the concentrates and fire refines the blister copper at the property. Products are ingots, wire bar, and semicontinuously cast cakes up to 23 feet in length.[4]

In late 1967 the rated capacity of the mill was increased to 25,000 tons per day from 17,500 tons per day. A reverberatory furnace, completed in December 1966, increased the maximum smelting capacity to 175 million pounds of copper annually.

The low sulfur content of the chalcocite ore has eased the burdens of keeping sulfur emissions below the primary and secondary ambient air standards established in the 1970 Clean Air Act.

Results of a Bureau of Mines study of three single-heading blasts in a long, straight haulageway at the White Pine copper mine were published in October 1971.[5]

Homestake Mining Co., which holds an option to lease the mineral rights on property owned by Universal Oil Products Co. (U.O.P.), announced it would investigate new methods of mining and milling the copper deposits in the Keweenaw Peninsula. Homestake Copper Co., a newly established, wholly owned subsidiary of Homestake Mining Co., will undertake the project. The first phase of the work will consist of dewatering the Centennial #6 mine, which has been closed since August 2, 1968, when economic conditions forced the Calumet Division of U.O.P. to cease production at that location. Geophysical and geochemical exploration will be undertaken on areas outside the prime Centennial mine target.

Iron Ore.—Iron ore shipments in 1972 were 12.7 million long tons, an increase of 7.3% over the 11.8 million long tons shipped in 1971. The average weighted mine value for Michigan usable iron ore shipments in 1972 was $13.98 compared with $13.51 in 1971. Iron ore continued to be the leading commodity in the State in terms of total mineral value.

Production, measured as shipments, came from two underground mines (the Mather mine in Marquette County and the Sherwood mine in Iron County), four open pit mines (the Empire, Republic, and Tilden mines in Marquette County, and the

Table 11.—Michigan: Mine production (recoverable) of silver and copper

	1970	1971	1972
Mines producing: Lode	1	1	2
Material sold or treated:			
Copper ore thousand short tons	7,638	6,891	8,250
Copper tailings do	--	--	40
Production (recoverable):			
Quantity:			
Silver troy ounces	891,579	670,052	785,100
Copper short tons	67,543	56,005	67,260
Value:			
Silver thousands	$1,579	$1,036	$1,323
Copper do	77,945	58,245	68,874
Total do	79,524	59,281	70,197

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[4] Beall, J. V. Copper in the U.S.—A Position Survey. Min. Eng., v. 25, No. 4, April 1973, pp. 38–39.

[5] Olson, J. J., and L. R. Fletcher. Airblast-Overpressure Levels From Confined Underground Production Blasts. BuMines RI 7574, 1971, 24 pp.

Groveland mine in Dickinson County), and four mines that have been closed but continued to ship from stockpiles (the Cliffs Shaft and Humboldt mines in Marquette County and the Homer and Wauseca mines in Iron County).

Pellet production at Cleveland-Cliffs Iron Co.'s Empire mine passed the 25-million-ton production mark on October 4, 1972. The mine began production late in 1963 with a rated annual capacity of 1.6 million tons of pellets. Expansions in 1966 and 1967 increased the production capacity to its current 3.4 million tons of pellets per year. A new expansion, started this year and scheduled to be completed in 1975, will raise the annual productivity by 1.8 million tons of pellets.

Operating under the same name from 1907 to 1928, the Empire mine produced 768,000 tons of a hard, red siliceous hematite ore with less than 40% iron content. The Cleveland-Cliffs Iron Co. and its partners revived the mine in 1963 and developed the first iron mining and processing complex to successfully produce high-grade (64%) iron pellets from Michigan's low-grade ore. The facility was the first iron ore processing mill in the United States to use full autogenous grinding.

The Tilden project, an iron ore mining and pelletizing venture of Cleveland-Cliffs and five North American steel companies, got underway with plans to produce 4 million tons of pellets annually starting in mid-1974. Additional expansion, in two phases, would increase production to 12 million tons a year by mid-1978.

Cleveland-Cliffs has owned the Tilden mine since 1865. It contains a low-grade, fine-grained iron oxide (hematite) ore deposit which has been mined by open pit methods on a small scale since 1927. Development of a process to turn low-grade, fine-grained hematite ore into iron-ore pellets made the current project possible. In cooperation with the U.S. Bureau of Mines, new technology was developed involving fine grinding, selective flocculation, desliming, and selective froth flotation to

Table 12.—Michigan: Usable iron ore [1] produced (direct-shipping and all forms of concentrates), by range

(Thousand long tons)

Year	Marquette range	Menominee range (Michigan part)	Gogebic range (Michigan part)	Total		
				Gross weight		Iron content (percent)
				Ore [2]	Iron content	
1854-1967	359,600	283,479	249,625	892,705	NA	NA
1968	10,086	3,684	--	13,770	8,339	60.56
1969	10,048	3,369	--	13,417	8,183	60.99
1970	10,363	2,394	--	12,757	7,950	[r] 62.31
1971	9,495	2,424	--	11,919	7,384	61.95
1972	9,131	2,533	--	11,664	7,332	62.86
Total [2]	408,723	[3] 297,883	[3] 249,625	956,232	NA	NA

[r] Revised. NA Not available.

[1] Exclusive, after 1905, of iron ore containing 5% or more manganese.

[2] Data may not add to totals shown because of independent rounding.

[3] Distribution by range partly estimated before 1906.

Table 13.—Michigan: Iron ore shipped from mines

(Thousand long tons)

Year	Direct-shipping ore [1]	Concentrates and agglomerates, total	Total usable ore	Proportion of beneficiated ore to total usable ore (percent)
1968	2,353	10,346	12,699	81.5
1969	1,972	12,086	14,058	86.0
1970	1,512	11,588	13,100	88.5
1971	1,439	10,393	[2] 11,833	87.8
1972	727	11,965	12,692	94.3

[1] Includes crushed, screened, and sized ore not further treated.

[2] Data does not add to total shown because of independent rounding.

produce a pellet containing 65% iron with less than 5% silica from the crude ore (36% iron content).

Water is an important requirement in the process, which needs 38 tons of water to produce 1 ton of iron ore pellets. To provide the water, Cleveland-Cliffs will dam the Middle Branch of the Escanaba River to create a 1,400 acre reservoir along a 6.5 mile stretch. The initial pelletizing plant at Tilden will circulate about 86,000 gallons of process water each minute, of which about 6,200 gallons per minute would be new or makeup water obtained from the reservoir; about 93% of the water would be reused continuously.

Partly to meet power needs for the Tilden project, the Upper Peninsula Generating Co. will construct two new units, almost doubling the output of its Presque Isle Station in Marquette. The Station presently consists of four units with a total output of 179 megawatts.

A land reclamation experiment on iron ore tailings at the Humboldt mine involved the planting of grasses, tree seedlings, and cuttings. The mine was closed at the end of 1970 by the Cleveland-Cliffs Iron Co., which had operated it for 18 years until it was commercially exhausted.

The Hanna Mining Co. added a sixth balling circuit to its pelletizing section at the Groveland mine. Its purpose is to help produce pellets with better structure and more uniform size.

Pig Iron and Steel.—Pig iron and steel were manufactured in the Detroit area. Pig iron shipments remained about the same but value increased 5.2%, as compared with the 1971 figures. According to the American Iron & Steel Institute, Michigan produced 9,380,000 short tons of steel in 1972 compared with 9,069,000 short tons in 1971.

The Steel Division of Ford Motor Co. began construction in 1971 of a new 390,000-square-foot hot strip steel rolling mill at the Rouge manufacturing complex in Dearborn; completion of the new mill is scheduled for 1974. The present hot strip mill, installed in 1935, was one of the first built in the United States, and is the oldest continuously running mill of its kind in this country. Additional expansion plans, with construction to begin early in 1973, include the installation of two new electric melting furnaces, additional soaking pits and annealing furnaces, a new recoil and oiling line, and new processing and shipping facilities.

A contract was awarded by the Michigan Seamless Tube Co. to the Swindell-Dressler Co. for the engineering and construction of an electric steel plant in Jackson, Mich., scheduled for completion in 1974. The plant will use a centrifugal casting method to produce 25-foot-long steel bars.

The Hoover Ball & Bearing Co. of Ann Arbor, Mich., and Cefilac, a subsidiary of Péchiney Ugine Kuhlmann of France, are jointly investing more than $15 million to build a new 100,000-square-foot plant near Bridgman, Lake Township, in southwest Michigan. The plant will be the first in the United States to convert scrap steel into wire products without the need for remelting. It is expected to be in operation by early 1974 with an annual capacity of 150,000 tons. The plant will use an electric-powered process.

Silver.—Silver was recovered from copper ore mined at the White Pine mine in Ontonagon County. Concentrates from a silver-recovery circuit in the White Pine mill were shipped to an outside smelter for silver recovery. Output of silver in 1972 was 17.2% more than in 1971, while value was 27.7% more than in 1971.

MINERAL FUELS

Coke.—Three companies operated oven-coke plants in Michigan in 1972. Total production of 3,677,000 short tons represented a decrease from the 3,780,000 short tons produced in 1971. The majority of the coke was consumed by blast furnaces. Michigan ranked fifth among the States in coke production and fourth in coke consumption.

Following a successful test at its Semet-Solvay Division's Ironton (Ohio) plant, Allied Chemical Corp. began installing the COALTEK system at its battery of 70 coke ovens in Detroit. The COALTEK unit preheats the coal and feeds it into the ovens via closed pipelines, eliminating the conventional charging cars and reducing air pollution.

Natural Gas.—Marketed production of natural gas increased substantially from 25,662 million cubic feet to 34,221 million cubic feet in 1972. Value in 1972 was $10,506,000, a 55% increase over that of 1971. Increased production was primarily due to the the new Niagaran reef fields. Many of the gas discoveries were not put into production immediately because of a lack of pipeline facilities and condensate handling equipment. A no-flare order, put into effect by the Michigan Department of Natural Resources late in 1971, prevented waste of oil-well gas from the Niagaran reef wells. It also has helped to expedite the construction of gas gathering systems.

One of the State utilities, Consumers Power Co., and one of the major producing companies, Shell Oil Co., are building natural gas processing plants on side-by-side locations at Kalkaska. Consumers Power Co. is constructing a facility that will handle 125 million cubic feet of gas daily; the plant is near the west terminal of Michigan Consolidated's line which will carry both the gas and gas liquids. Shell Oil Co.'s facility is designed to handle up to 350 million cubic feet of gas daily. The new plants are expected to be operational in early 1974. Shell Oil Co., however, is experiencing construction difficulties that may delay completion of its facility.

Compilations by the Gas Section, Public Utilities Division of the Michigan Public Service Commission showed gas imports of 906,684,020 thousand cubic feet in 1972, a slight decrease from the 909,209,140 thousand cubic feet imported in 1971. The largest wholesale supplier of gas to Michigan is the Michigan Wisconsin Pipe Line Co. Michigan presently uses about 1 trillion cubic feet of gas annually, about 95% of which is imported.

According to estimates of the American Gas Association (AGA), proved natural gas reserves in Michigan on December 31, 1972, were 1,296,815 million cubic feet, a gain of 280,333 million cubic feet.

Natural Gas Liquids.—Production of natural gas liquids decreased 19.6% from that of 1971, to 1,228,000 barrels. Of the total production, 395,000 barrels were natural gasoline and 833,000 barrels were liquefied petroleum (LP) gases. LP gases averaged $2.73 per barrel compared with $2.69 in 1971, and natural gasoline averaged $2.78 per barrel compared with $2.74 in 1971.

According to the AGA, proved reserves of natural gas liquids totaled 19,026,000 barrels at yearend 1972 compared with 12,584,000 barrels at yearend 1971.

Peat.—Michigan continued to lead the Nation in peat production, accounting for 36% of the U.S. total. Production, which decreased from 209,835 short tons in 1971 to 208,691 short tons in 1972, was obtained from 11 counties. Sixty-nine percent of the State total came from Lapeer and Sanilac Counties; other producing counties were Allegan, Eaton, Ingham, Kent, Mecosta, Monroe, Oakland, St. Joseph, and Shiawassee.

Sales totaled 219,251 short tons in 1972 as compared with 202,189 short tons in 1971. Reed-sedge peat accounted for 78.8% of the total sales; moss peat, 12.5%; and humus peat, 8.7%. Over 82% of the sales was in packaged form. Ninety-four percent of the total output was used for general soil improvement, with the remainder being used as an ingredient for potting soils, for mushroom beds, for packing flowers, etc.

Petroleum.—Michigan's annual oil production, having followed a declining trend since 1962, began to climb in 1971 and continued upward in 1972. Output in 1972 was 12,990,000 barrels valued at $41.6 million. The State average value per barrel was $3.20 for 1972, compared with $3.27 in 1971. Increased oil production was directly related to the new Niagaran reef reservoirs.

Albion-Scipio, the great Trenton and Black River field, passed the 100-million-barrel mark in 1972, making it the first field in Michigan to achieve "giant" status. Production in this field amounted to 3,948,650 barrels in 1972, compared with 4,714,659 barrels in 1971.

Niagaran oil production exceeded the Trenton Trend in gross oil runs in 1972.[6] About 5,245,930 barrels of the State's total oil and condensate runs were credited to "new Niagaran," accounting for 40% of the State's oil production. If the well to refinery facilities in or projected are placed into service in 1973, runs can easily be doubled next year.

Eighteen waterflood projects, having 462 injection wells, were in operation during the year. They accounted for 1,896,396 barrels of oil in 1972, or 14.6% of the total oil production in the State for the year.[7]

Reserves of crude oil, according to the American Petroleum Institute (API), were

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[6] Oil and Gas News. V. 79, No. 17, Apr. 27, 1973, p. 7.

[7] Oil and Gas Compact Bulletin. V. 32, No. 1, June 1973, p. 29.

62,002,000 barrels on December 31, 1972, an increase of 3,237,000 barrels over that of the previous year.

Total Leonard, Inc., a wholly owned subsidiary of Total Petroleum (North America) Ltd., put into operation in July its new platforming unit at Alma. This unit increased the refinery's capacity for production of high-octane gasoline by nearly 40%. Revamping of crude processing facilities was undertaken to provide raw material for the new Platformer as well as additional crude processing capacity.

Mobil Oil Co. Inc., discontinued refining operations at its 46,600-barrel-per-day refinery at Woodhaven in the Detroit area. The facility, built in 1929, was capable of producing substantially less home heating oil and gasoline per barrel of crude oil than more modern refineries.

Marathon Oil Co. converted its fluid catalytic cracking unit at Detroit to "riser" cracking, a recently developed technology that increases the yield of gasoline per barrel of feedstock.

Petroleum and Natural Gas Exploration and Development.—Total well completions

Table 14.—Michigan: Crude oil production, by county

(Thousand 42-gallon barrels and thousand dollars)

County	1971		1972	
	Quantity	Value[1]	Quantity	Value[1]
Allegan	122	399	114	364
Antrim	--	--	(2)	1
Arenac	231	755	201	642
Barry	12	39	10	32
Bay	235	765	218	697
Calhoun	1,533	5,009	1,255	4,015
Clare	394	1,287	383	1,225
Crawford	524	1,712	586	1,876
Eaton	--	--	3	11
Genesee	68	222	46	148
Gladwin	279	912	274	875
Grand Traverse	3	10	69	221
Gratiot	7	23	3	9
Hillsdale	2,356	7,698	2,018	6,456
Huron	(2)	1	(2)	(2)
Ingham	348	1,137	1,149	3,677
Isabella	187	611	144	461
Jackson	849	2,774	688	2,202
Kalkaska	302	987	828	2,650
Kent	58	190	53	169
Lake	186	608	137	439
Lapeer	81	265	95	304
Lenawee	(2)	1	--	--
Macomb	4	13	3	8
Mason	29	95	64	205
Mecosta	101	330	54	172
Midland	185	604	154	494
Missaukee	545	1,781	572	1,829
Monroe	2	7	2	5
Montcalm	123	402	107	342
Muskegon	20	65	16	50
Newaygo	16	52	13	40
Oakland	1	3	(2)	1
Oceana	74	242	51	164
Ogemaw	346	1,130	411	1,316
Osceola	622	2,032	531	1,699
Oscoda	2	7	1	5
Otsego	815	2,663	1,404	4,490
Ottawa	51	167	54	172
Presque Isle	(2)	1	(2)	1
Roscommon	209	683	287	919
St. Clair	873	2,852	900	2,880
Saginaw	21	69	18	59
Shiawassee	7	23	4	12
Tuscola	60	196	53	169
Van Buren	5	16	6	20
Washtenaw	5	16	3	11
Wayne	4	13	6	20
Wexford	--	--	(2)	(2)
Total[3]	11,893	38,859	12,990	41,556

[1] County values calculated by using State average value per barrel: $3.27 for 1971 and $3.20 for 1972.
[2] Less than ½ unit.
[3] Data may not add to totals shown because of independent rounding.

Source: State of Michigan, Department of Natural Resources.

Table 15.—Michigan: Oil and gas well drilling completions, by county, in 1972

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Allegan	1	--	--	--	--	2	3	5,021
Antrim	--	--	--	1	--	1	2	12,365
Arenac	--	--	--	--	--	2	2	6,960
Barry	--	--	--	--	--	4	4	16,944
Bay	--	--	--	--	--	2	2	6,946
Benzie	--	--	--	--	--	1	1	5,165
Berrien	--	--	--	--	--	2	2	1,438
Calhoun	1	2	7	--	4	2	16	57,392
Clinton	--	--	--	--	--	1	1	3,111
Crawford	1	--	1	1	1	1	5	37,698
Eaton	--	--	1	2	--	6	9	42,012
Gladwin	1	--	8	--	--	4	13	51,670
Grand Traverse	--	1	--	5	3	10	19	123,434
Gratiot	--	--	--	--	--	1	1	3,270
Hillsdale	--	--	3	--	--	4	7	28,053
Huron	--	--	--	--	--	2	2	15,595
Ingham	15	6	13	5	2	11	52	223,544
Ionia	--	--	--	--	--	2	2	7,567
Jackson	--	--	2	--	--	6	8	34,943
Kalkaska	11	1	3	8	8	10	41	280,217
Kent	--	--	--	--	--	1	1	2,115
Lake	1	--	--	--	--	--	1	3,555
Lapeer	5	--	--	--	--	2	7	22,859
Lenawee	--	--	--	--	--	2	2	7,704
Livingston	--	1	--	--	--	2	3	16,172
Macomb	--	--	2	--	--	7	9	28,822
Manistee	--	--	--	--	1	1	2	11,125
Mason	1	--	1	3	--	--	5	15,832
Mecosta	--	--	--	--	--	4	4	14,603
Missaukee	1	--	--	--	--	1	2	8,096
Montcalm	--	--	1	--	--	--	1	3,366
Montmorency	--	--	--	--	--	1	1	5,350
Muskegon	--	--	--	--	--	1	1	4,000
Oceana	--	--	1	--	--	2	3	5,700
Osceola	--	2	1	--	--	--	3	4,879
Otsego	15	--	8	9	--	8	40	246,088
Ottawa	--	--	--	--	--	1	1	1,620
Presque Isle	--	--	--	--	--	3	3	10,319
St. Clair	--	--	7	--	1	9	17	51,686
Tuscola	--	--	--	--	--	1	1	7,941
Van Buren	--	--	1	--	--	--	1	1,182
Washtenaw	--	--	1	--	--	4	5	24,398
Wexford	--	--	--	--	1	3	4	25,501
Total	58	13	61	34	21	127	309	1,486,258

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

in Michigan, according to the API, increased from 302 wells in 1971 to 309 wells in 1972. Of the 309 wells drilled, 87 were completed as oil wells, 34 as gas wells, and 188 as dry holes. Overall success ratio was 39%; 30% of the exploratory wells were completed as oil and gas producers. The total footage drilled in new wells was 1,486,258 feet, of which 576,718 feet was in development completions and 909,540 feet was in exploratory completions.

Ingham County, which was almost ignored by oil and gas developers until 2 years ago, accounted for 16.8% of the well completions; this included 20 oil wells, 8 gas wells, and 24 dry holes. Kalkaska County was second with 41 well completions, which included 19 oil wells, 9 gas wells, and 13 dry holes. Otsego County was third with 40 well completions, of which 24 produced oil, none were gas wells, and 16 were dry holes.

For the fourth straight year, Niagaran reef exploration continued to dominate oil and gas activity in the State. The new discoveries are opening previously untested basin areas. The present play actually started in 1968 with a well near Onaway in Presque Isle County. Exploration in 1972, according to the Geological Survey, Michigan Department of Natural Resources, was concentrated mainly in Grand Traverse, Kalkaska, and Otsego Counties in the northern district and in the Ingham-Eaton-northeastern Calhoun region in the southern part of the basin. Most of the new reefs were found in the northern part of Lower Michigan. One of these discoveries, the Hamlin 13–19n–18w field in Mason County, extended the Niagaran trend about 150 miles southwest of the Onaway field. In December, the first Niagaran reef discovery for Manistee County was completed.

The old "bread and butter" areas of the State were for the most part ignored in 1972. Gladwin County accounted for 13 Dundee completions, only one of which was completed as a producing well. Such historic Traverse province areas as Allegan, Kent, Ottawa, and Van Buren Counties accounted for only six completions, with only one of these a producer. Calhoun, Hillsdale, and Jackson Counties, in the Albion-Pulaski-Scipio trend area, accounted for only 20 Trenton completions, none of which were productive. In St. Clair and Macomb Counties, where a number of Niagaran reefs were found during the 1960's, only 26 wells were completed, only one of which was rated a commercial well.

Oil and gas lease sales on State-owned land were held for the first time since November 1969. In July, a record Michigan bonus of $9,640,971 was paid for 426,369 acres in 11 counties in the northern part of the Lower Peninsula. The average lease price was $22.61 per acre, compared with $2.10 per acre in 1968 and $11 per acre in 1969. In December, the second sale brought a bonus of $523,157 for 167,428 acres, which gives an average price per acre of $3.13.

Three major oil companies led the way in finding new fields in Michigan's Lower Peninsula. In the northern area, Shell Oil Co. led the way, followed by Amoco Production Co., a Standard affiliate; in the southern area, Mobil Oil Corp. was the leader. Independents contributed a number of new fields including the previously mentioned Hamlin 13–19n–18w, which extended the known Niagaran reef area for the first time as far west as Mason County.

Pipeline Construction.—Mobil Oil Co. Inc., received approval to build a pipeline to serve its expanding Ingham County oil operations. The oil is presently being moved from the various fields to refiners by truck. By building a pipeline system, involving 13 miles of 8-inch and 8 miles of 4-inch pipe, Mobil will be able to carry crude to Lakehead Pipe Line's 30-inch Canada-Wisconsin loop that extends northeast to Port Huron. At Stockbridge, where Mobil will make the tap for its new line, it also will have a switch to Michigan-Ohio's Mt. Pleasant-to-Toledo line. The two junctions will give Mobil crude movement to many intrastate and interstate markets, up to 25,000 barrels per day.

Shell Pipe Line Corp. has been authorized to build an 85-mile pipeline system to carry crude oil from Niagaran reef fields in Kalkaska, Crawford, and Otsego Counties. The first section of the system, a 26-mile section of 8-inch and 16-inch line, will deliver oil produced in Otsego County to Lakehead Pipeline Co.'s Lewiston station in northeast Crawford County. It will eliminate having to move large quantities of crude oil by truck. Capacity of the system when fully completed is expected to exceed 100,000 barrels per day, which is greater than the peak in the past of any Michigan oil production.

Michigan Wisconsin Pipe Line Co. received approval from the Federal Power Commission for a $58.3 million pipeline system expansion. It will increase the capacity of its transmission system by building 187 miles of 36-inch loop line on its Louisiana main line system. Michigan Wisconsin Pipe Line Co. delivers more than half of its total yearly capacity to Michigan. During 1972, Michigan utilities received from the company over 430 billion cubic feet of gas.

Table 16—Principal producers [1]

Commodity and company	Address	Type of activity	County
Abrasives, metallics:			
Abrasive Materials, Inc.	Box 291 Hillsdale, Mich. 49242	Plant	Hillsdale.
Cleveland Metal Abrasive Co.	887 East 67th St. Cleveland, Ohio 44103	do	Livingston.
Ervin Industries, Inc.	Box 1168 Ann Arbor, Mich. 48106	do	Lenawee.
Cement:			
Dundee Cement Co.	Box 122 Dundee, Mich. 48131	Portland, wet process	Monroe.
Martin Marietta Cement, Great Lakes Div.	Box 8 Bay City, Mich. 48706	Portland and masonry, wet process.	Bay.

See footnote at end of table.

Table 16.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Cement—Continued			
Medusa Cement Co., Div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	Portland, wet process	Charlevoix.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	Portland and masonry, dry process.	Alpena.
Peerless Cement Co., div. of American Cement Corp.:	2000 The Executive Plaza Detroit, Mich. 48226		
Brennan Ave. Plant		Portland, wet process	Wayne.
Detroit Plant		Portland and masonry, wet process.	Do.
Port Huron Plant		Portland, wet process	St. Clair.
Penn-Dixie Cement Corp.	Box 307 Petoskey, Mich. 49770	Portland and masonry, wet process.	Emmet.
Wyandotte Cement Inc.	3505 Biddle Ave. Wyandotte, Mich. 48192	do	Wayne.
Clays and shale:			
Construction Aggregates Corp.	13600-104th Ave. Grand Haven, Mich. 49417	Pit and plant	Ottawa.
Dundee Cement Co.	Box 122 Dundee, Mich. 48131	Pit	Monroe.
Light Weight Aggregate Corp.	27611 Schoolcraft Rd. Livonia, Mich. 48150	Pit and plant	Wayne.
Martin Marietta Cement, Great Lakes Div.	Box 8 Bay City, Mich. 48706	Pit	Saginaw.
Medusa Cement Co., Div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	Pit	Antrim.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	Pit	Alpena.
Peerless Cement Co., div. of American Cement Corp.	2000 The Executive Plaza Detroit, Mich. 48226	Pits	St. Clair and Wayne.
Penn-Dixie Cement Corp.	Box 307 Petoskey, Mich. 49770	Pit	Emmet.
Coke:			
Industrial Chemicals Div., Allied Chemical Corp.	Box 70 Morristown, N.J. 07960	Coke ovens	Wayne.
Ford Motor Co.	The American Rd. Dearborn, Mich. 48121	do	Do.
National Steel Corp. Great Lakes Steel Div.	2800 Grant Bldg. Pittsburgh, Pa. 15219	do	Do.
Copper: White Pine Copper Co., subsidiary of Copper Range Co.	Box 427 White Pine, Mich. 49971	Mine and mill	Ontonagon.
Gypsum:			
Georgia-Pacific Corp. Gypsum Div.	900 SW. 5th Ave. Portland, Oreg. 97204	Underground mine, and calcining and board plant.	Kent.
Grand Rapids Gypsum Co.	Box 1674 Grand Rapids, Mich. 49501	do	Do.
Michigan Gypsum Co.	2840 Bay Rd. Saginaw, Mich. 48601	Open pit mine	Iosco.
National Gypsum Co.	325 Delaware Ave. Buffalo, N.Y. 14202	Open pit mine and calcining and board plant.	Do.
United States Gypsum Co.	101 South Wacker Dr. Chicago, Ill. 60606	Open pit mine Calcining and board plant.	Do. Wayne.
Iron ore:			
Cleveland-Cliffs Iron Co.:	1460 Union Commerce Bldg. Cleveland, Ohio 44115		
Empire		Open pit mine, concentrator, and agglomerator.	Marquette.
Mather		Underground mine. Ore treated at the ore improvement plant and Pioneer pellet plant.	Do.
Ore improvement plant		Processes Mather ore	Do.
Pioneer pellet plant		Pelletizes ore from the Mather mine.	Do.
Republic		Open pit mine, concentrator, and agglomerator. Part of the concentrates pelletized at the Humboldt plant.	Do.
Tilden		Open pit mine and stockpile shipments.	Do.

See footnote at end of table.

Table 16.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Iron ore—Continued			
The Hanna Mining Co.: Groveland.	100 Erieview Plaza Cleveland, Ohio 44114	Open pit mine, concentrator, and agglomerator.	Dickinson.
Inland Steel Co.: Sherwood	30 West Monroe St. Chicago, Ill. 60603	Underground mine	Iron.
Iron and steel:			
Ford Motor Co	The American Rd. Dearborn, Mich. 48121	Iron blast furnaces and open-hearth steel furnaces.	Wayne.
McLouth Steel Corp	300 South Livernois Ave. Detroit, Mich. 48217	do	Do.
National Steel Corp., Great Lakes Steel Div.	2800 Grant Bldg. Pittsburgh, Pa. 15219	do	Do.
Lime:			
Detroit Lime Co., subsidary of Edward C. Levy Co.	8800 Dix Ave. Detroit, Mich. 48209	Quicklime, shaft and rotary kilns.	Do.
The Dow Chemical Co	2020 Dow Center Midland, Mich. 48640	Quicklime, 3 rotary kilns, continuous hydrator.	Mason.
Marblehead Lime Co	300 West Washington St. Chicago, Ill. 60606	Quicklime, 2 rotary kilns.	Wayne.
BASF Wyandotte Corp	1609 Biddle Ave. Wyandotte, Mich. 48192	Quicklime, 9 shaft kilns.	Do.
Peat:			
Anderson Peat Co	882 Graham Rd. Imlay City, Mich. 48444	Bog, processing plant	Lapeer.
Fletcher & Rickard	54001 Grand River Rd. New Hudson, Mich. 48165	do	Oakland.
J. M. Huber Corp	Peat Department P.O. Box 812 Sandusky, Mich. 48471	do	Sanilac.
Michigan Peat	8 Executive Mall Valley Forge, Pa. 19481	Bogs, processing plant	Do.
Scenic Lakes, Inc	Box 926 East Lansing, Mich. 48823	Bog, processing plant	Shiawassee.
Expanded perlite:			
Harborlite Corp	P.O. Box 458 Escondido, Calif. 92025	Processing plant	Kalamazoo.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Iosco.
United States Gypsum Co.	101 South Wacker Dr. Chicago, Ill. 60606	do	Wayne.
Petroleum refineries:			
Bay Refining Div., The Dow Chemical Co.	4868 Wilder Rd. Bay City, Mich. 48709		Bay.
Crystal Refining Co	901 North Williams Carson City, Mich. 48811		Montcalm.
Lakeside Refining Co	2705 East Cork Kalamazoo, Mich. 49001		Kalamazoo.
Total Leonard, Inc., Alma Division	East Superior St. Alma, Mich. 48801		Gratiot.
Marathon Oil Co	1300 South Fort St. Detroit, Mich. 48217		Wayne.
Mobil Oil Co., Inc	Box 477 Trenton, Mich. 48183		Do.
Osceola Refining Co	Box 178 Reed City, Mich. 49677		Ogemaw.
Salt and salines:			
Diamond Crystal Salt Co	916 South Riverside St. Clair, Mich. 48079	Brine wells and processing plant: Salt.	St. Clair.
The Dow Chemical Co.:			
Ludington Plant	Midland, Mich. 48640	Brine wells and processing plant: Bromine, calcium-magnesium compounds, magnesium compounds.	Mason.
Midland Plant		Brine wells and processing plant: Bromine, calcium-magnesium compounds, iodine, magnesium compounds, salt.	Midland.
Harbison-Walker Refractories Co.	2 Gateway Center Pittsburgh, Pa. 15222	Processing plant: Magnesium compounds.	Mason.
Hardy Salt Co	P.O. Drawer 449 St. Louis, Mo. 61366	Processing plant: Salt	Manistee.
Hooker Chemical Corp	Box 295 Montague, Mich. 49437	Brine wells and processing plant: Salt	Muskegon.
International Salt Co., Inc.	Clarks Summit, Pa. 18411	Underground salt mine	Wayne.

See footnote at end of table.

Table 16.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Salt and salines—Continued			
Martin Marietta Chemicals, Refractories Div.	Executive Plaza II Hunt Valley, Md. 21030	Brine wells and processing plant: Magnesium compounds.	Manistee.
Michigan Chemical Corp:	351 East Ohio St. Chicago, Ill. 60611		
St. Louis Plant		Brine wells and processing plant: Bromine, calcium-magnesium compounds, magnesium compounds, salt.	Gratiot.
Morton Chemical Co., div. Morton-Norwich Products, Inc.	110 North Wacker Dr. Chicago, Ill. 60606	Brine wells and processing plant: Bromine, magnesium compounds.	Manistee.
Morton Salt Co., div. of Morton-Norwich Products, Inc.	do		
Manistee Plant		Brine wells, and processing plant: Salt.	Do.
Port Huron Plant		do	St. Clair.
Pennwalt Corp	3 Penn Center Philadelphia, Pa. 19102	do	Wayne.
Wilkinson Chemical Corp	Mayville, Mich. 48744	Brine wells and processing plant: Calcium-magnesium compounds.	Lapeer.
BASF Wyandotte Corp	1609 Biddle Ave. Wyandotte, Mich. 48192	Brine wells and processing plant: Salt.	Wayne.
Sand and gravel:			
American Aggregates Corp.	Drawer 160 Greenville, Ohio 45331	Pits and stationary plants.	Kalamazoo, Livingston, Macomb, Oakland.
Construction Aggregates Corp.	120 South LaSalle St. Chicago, Ill. 60603	do	Ottawa.
Grand Rapids Gravel Co	2700–28th St., SW Grand Rapids, Mich. 49509	do	Kent.
Holloway Sand & Gravel Co.	29250 Wixom Rd., Box 247 Wixom, Mich. 48096	Pits and portable plants.	Genesee, Oakland, Ogemaw, Otsego.
Holly Sand & Gravel Div., J. P. Burroughs & Sons Inc., Aggregate Div.	Box 1468 Saginaw, Mich. 48605	Pit and stationary plant.	Oakland.
McCormick Sand Corp	P.O. Box 506 Muskegon, Mich. 49443	Stationary plant	Ottawa.
Mickelson Corp	435 Granger Rd. Oxford, Mich. 48051	Pit, dredges, portable plant.	Do.
Molesworth Contracting Co.	321 Park Ave. Yale, Mich. 48097	Pits and portable plants.	Lapeer, Macomb, St. Clair, Sanilac.
Natural Aggregates Corp	65545 Mound Rd. Romeo, Mich. 48065	Pits, dredge, portable and stationary plants.	Livingston and Macomb.
New Hudson Sand & Gravel Inc.	Box 174 New Hudson, Mich. 48165	Pits and stationary plants.	Oakland.
Sargent Sand Co	2840 Bay Rd. Saginaw, Mich. 48604	do	Bay, Mason, Saginaw, Tuscola.
Spartan Aggregates	P.O. Box 25 Holt, Mich. 48842	do	Clinton, Ingham, Oakland.
Standard Sand Co	P.O. Box 290 Grand Haven, Mich. 49417	Stationary plant	Ottawa.
Silver: White Pine Copper Co. subsidiary of Copper Range Co.	Box 427 White Pine, Mich. 49971	Byproduct silver	Ontonagon.
Smelters: White Pine Copper Co., subsidiary of Copper Range Co.	do	Primary copper smelter	Do.
Stone:			
Granite: Caspian Construction Co.	100 West Caspian Caspian, Mich. 49915	Quarry and stationary plant.	Dickinson.
Limestone and dolomite:			
Bethlehem Mines Corp., Bethlehem Steel Corp.	701 East Third St. Bethlehem, Pa. 18016	do	Chippewa.
Cheney Limestone Co.	Box 6 Bellevue, Mich. 49021	do	Eaton.
Detroit Edison Co	2000 South Second Ave. Detroit, Mich. 48226	Quarry and portable plant.	Monroe.
Dundee Cement Co	Box 122 Dundee, Mich. 48131	Quarry and stationary plant.	Do.

See footnote at end of table.

Table 16.—Principal producers [1]—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Limestone and dolomite:			
The France Stone Co.	1800 Toledo Trust Bldg. Toledo, Ohio 43604	Quarry and stationary plant.	Monroe.
National Gypsum Co., Huron Cement Div.	17515 West 9 Mile Rd. Honeywell Center Southfield, Mich. 48075	do	Alpena.
Inland Lime & Stone Co., div. of Inland Steel Co.	Gulliver, Mich. 49840	Quarries and stationary plants.	Mackinac, Schoolcraft.
Medusa Cement Co., Div. Medusa Corp.	Box 5668 Cleveland, Ohio 44101	Quarry and stationary plant.	Charlevoix.
Michigan Foundation Quarry Co., Inc.	110 West Jefferson Ave. Trenton, Mich. 48183	do	Wayne.
The Michigan Stone Co.	Ottawa Lake, Mich. 49267	Quarries and stationary plants.	Monroe.
Penn-Dixie Cement Corp.	Box 307 Petoskey, Mich. 49770	do	Emmet.
Presque Isle Corp.	Box 426 Alpena, Mich. 49707	do	Presque Isle.
United States Steel Limestone Operations, United States Steel Corp.	Rogers City, Mich. 49779	do	Mackinac, Presque Isle.
Wallace Stone Co., div. of J. P. Burroughs & Son, Inc., Aggregate Div.	Box 1468 Saginaw, Mich. 48605	Quarry and stationary plant.	Huron.
Marl:			
Gerald Arnsman	Route 1 Hopkins, Mich. 49328	Pit	Allegan.
Case Brothers	Route 2, Box 136 Union City, Mich. 49094	do	Calhoun.
Hayward Dry Marl	Route 2 Vicksburg, Mich. 49097	do	Kalamazoo.
Poehlman & Son	Route 2 Cassopolis, Mich. 49031	do	Cass.
Sandstone:			
Ottawa Silica Co.	33620 Streicher Rd. Rockwood, Mich. 48173	Pit and stationary plant.	Wayne.
Napoleon Stone Quarry	331 Austin Rd. Napoleon, Mich. 49261	Quarry and finishing plant.	Jackson.
Jude Stone Quarry	338 Austin Rd. Napoleon, Mich. 49261	do	Do.
Recovered sulfur:			
Total Leonard Inc., Alma Div.	East Superior St. Alma, Mich. 48801	Byproduct sulfur recovery.	Gratiot.
Marathon Oil Co.	1300 South Fort St. Detroit, Mich. 48217	do	Wayne.
Mobil Oil Co., Inc.	Box 477 Trenton, Mich. 48183	do	Do.
Exfoliated vermiculite: Construction Products Div., W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	Processing plant	Do.

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[1] A number of oil and gas producing companies operate in Michigan and they are listed in several commercial directories.

The Mineral Industry of Minnesota

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Minnesota Geological Survey for collecting information on all minerals except fuels.

By Harold J. Polta [1]

Minnesota's mineral output in 1972, valued at $660 million, was 8% above that of 1971. Iron ore continued as the principal mineral commodity. It accounted for more than 91% of the State's mineral output value. Sand and gravel production, valued at $33.5 million, accounted for 5% of the total. The iron ore produced in Minnesota accounted for 65% of the total U.S. iron ore production. Production from taconite was 34.5 million tons and that from natural ores, 14.5 million tons. All came from open pits.

Because almost all iron ore production came from St. Louis and Itasca Counties, these two counties contributed over 92% of the State's mineral production value. Value of production from St. Louis County was 81% of the State total; that from Itasca County, 11% of the total.

Employment in Minnesota's iron ore industry in 1972 totaled about 12,000, according to the Lake Superior Industrial Bureau, an organization supported by the iron ore industry. Of these, about 10,000 were employed in taconite operations. The taconite industry payroll was stated as totaling $123,756,000; that of the natural ore industry, $26,600,000. Other economic data released by the Bureau showed that goods and services purchased by taconite operations in 1972 amounted to $161,775,000; those purchased by natural ore operations, $16,350,000.

The Minnesota Department of Natural Resources will be decentralized by July 1, 1973, according to a reorganization plan announced late in the year. The plan called for the creation of six resource management regions. The stated objective of the regional setup was to facilitate coordinated planning and managing of all natural resources so that consideration be given to primary, secondary, or equal uses of natural resources for the benefit of all.

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Table 1.—Mineral production in Minnesota [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays ..... thousand short tons	223	$335	[2] 167	[2] $251
Gem stones	NA	18	NA	14
Iron ore (usable) ..... thousand long tons, gross weight	49,054	547,607	50,595	601,869
Manganiferous ore (5 to 35% Mn) ... short tons, gross weight	169,732	W	119,824	W
Sand and gravel ..... thousand short tons	44,916	37,645	36,792	33,454
Stone ..... do	5,838	14,346	5,757	16,318
Value of items that cannot be disclosed: Abrasives, cement, kaolin, lime, peat and values indicated by symbol W	XX	8,880	XX	7,768
Total	XX	608,776	XX	659,669
Total 1967 constant dollars	XX	517,642	XX	p 548,779

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Minnesota, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Aitkin	W	$109	Sand and gravel.
Anoka	--	W	Do.
Becker	W	117	Do.
Beltrami	W	W	Do.
Benton	W	114	Do.
Big Stone	W	W	Stone, sand and gravel.
Blue Earth	$1,661	1,397	Do.
Brown	W	W	Sand and gravel, clays.
Carlton	W	W	Sand and gravel, peat, clays.
Carver	W	W	Sand and gravel, clays.
Cass	140	190	Sand and gravel.
Chippewa	250	W	Do.
Chisago	198	W	Do.
Clay	W	W	Sand and gravel, lime.
Clearwater	219	W	Sand and gravel.
Cook	W	W	Do.
Cottonwood	117	W	Do.
Crow Wing	1,706	1,494	Manganiferous ore, iron ore, sand and gravel.
Dakota	W	W	Sand and gravel, stone.
Dodge	W	W	Stone, sand and gravel.
Douglas	W	62	Sand and gravel.
Faribault	W	120	Do.
Fillmore	772	606	Stone, sand and gravel.
Freeborn	659	391	Sand and gravel.
Goodhue	W	W	Sand and gravel, stone.
Grant	W	W	Sand and gravel.
Hennepin	W	4,447	Sand and gravel, clays, stone.
Houston	W	W	Stone, sand and gravel.
Hubbard	W	--	
Isanti	8	29	Sand and gravel.
Itasca	81,585	75,527	Iron ore, sand and gravel, peat.
Jackson	255	W	Sand and gravel.
Kanabec	38	75	Do.
Kandiyohi	W	274	Do.
Kittson	W	W	Do.
Koochiching	W	116	Do.
Lac qui Parle	481	414	Stone, sand and gravel.
Lake	W	80	Sand and gravel.
Lake of the Woods	W	W	Do.
Le Sueur	W	W	Sand and gravel, stone.
Lincoln	W	W	Sand and gravel.
Lyon	W	90	Do.
McLeod	W	27	Do.
Mahnomen	6	--	
Marshall	282	212	Sand and gravel.
Martin	211	300	Do.
Meeker	W	W	Do.
Mille Lacs	W	W	Stone, sand and gravel.
Morrison	38	W	Sand and gravel.
Mower	W	W	Stone, sand and gravel.
Murray	W	7	Sand and gravel.
Nicollet	W	W	Sand and gravel, stone.
Nobles	179	W	Sand and gravel.

Table 2.—Value of mineral production in Minnesota, by county—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Norman	W	$96	Sand and gravel.
Olmsted	W	W	Stone, sand and gravel.
Otter Tail	521	W	Sand and gravel.
Pennington	W	122	Do.
Pine	47	17	Do.
Pipestone	220	W	Do.
Polk	W	W	Sand and gravel, lime.
Pope	W	W	Sand and gravel.
Ramsey	W	W	Sand and gravel, clays.
Red Lake	W	W	Sand and gravel.
Redwood	206	87	Stone, clays, sand and gravel.
Renville	W	W	Stone, sand and gravel.
Rice	W	W	Sand and gravel, stone.
Rock	818	640	Stone, abrasives, sand and gravel.
Roseau	W	59	Sand and gravel.
St. Louis	476,053	534,260	Iron ore, cement, sand and gravel, stone, lime, peat.
Scott	W	W	Stone, sand and gravel.
Sherburne	687	931	Sand and gravel.
Sibley	34	--	
Stearns	W	W	Stone, sand and gravel.
Steele	W	W	Sand and gravel, stone.
Stevens	481	W	Sand and gravel.
Swift	W	W	Do.
Todd	W	W	Do.
Traverse	W	W	Do.
Wabasha	W	W	Stone, sand and gravel.
Wadena	W	W	Sand and gravel, stone.
Waseca	W	W	Sand and gravel.
Washington	W	W	Sand and gravel, stone.
Watonwan	W	8	Sand and gravel.
Wilkin	W	W	Do.
Winona	W	W	Stone.
Wright	480	W	Sand and gravel, stone.
Yellow Medicine	W	424	Stone, sand and gravel.
Undistributed [1]	40,577	36,832	
Total [2]	608,776	659,669	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

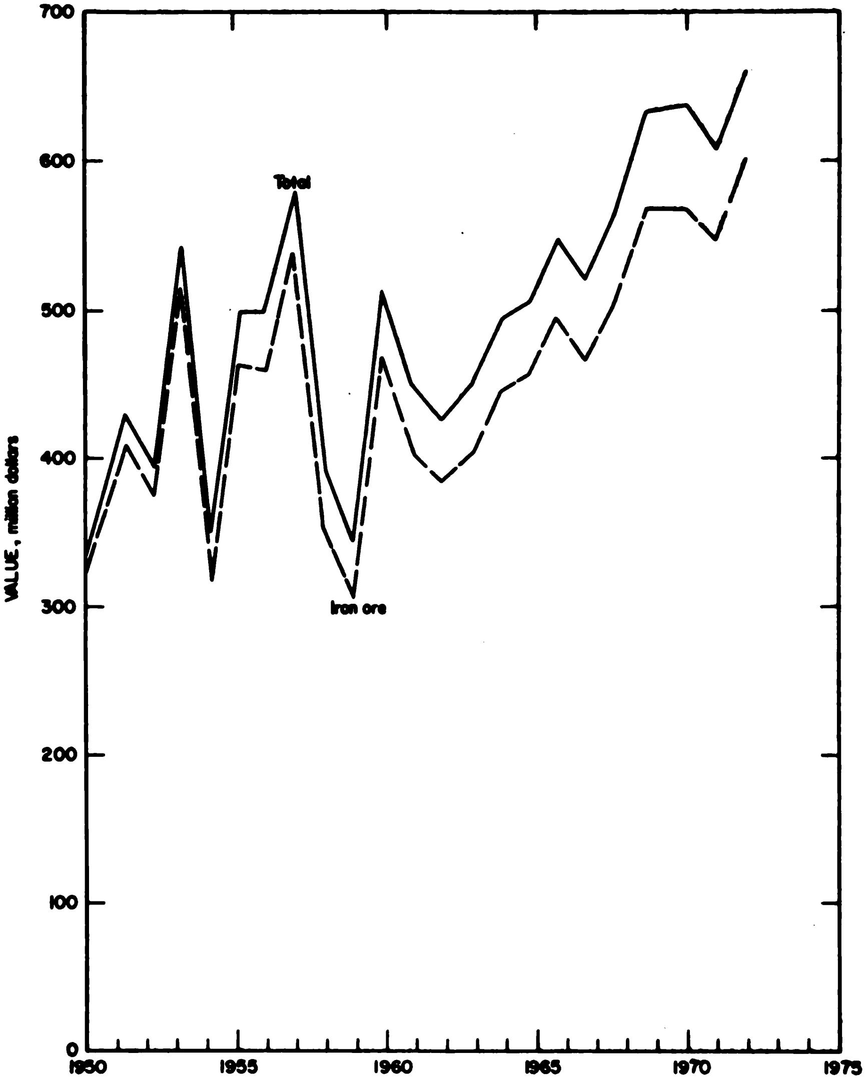

Figure 1.—Value of iron-ore shipments and total value of mineral production in Minnesota.

Table 3.—Indicators of Minnesota business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force thousands	1,655.0	1,690.5	+2.1
Unemployment do	97.3	94.5	−2.9
Employment:			
Manufacturing do	299.4	307.5	+2.7
Construction do	63.2	60.0	−5.1
Mining do	13.9	13.0	−6.5
Transportation and public utilities do	85.6	86.6	+1.2
Wholesale and retail trade do	319.9	332.3	+3.9
Finance, insurance and real estate do	65.0	67.2	+3.4
Services do	225.7	238.9	+5.8
Government do	239.7	246.0	+2.6
Personal income:			
Total millions	$15,564	$16,877	+8.4
Per capita	$4,032	$4,332	+7.4
Construction activity:			
Value of authorized nonresidential construction millions	$256.8	$282.6	+10.0
Number of private and public residential units authorized	30,818	33,925	+10.0
State highway commission contracts awarded millions	$116.0	e $125.0	+7.8
Portland cement shipments to and within Minnesota thousand short tons	1,634	1,602	−2.0
Farm marketing receipts millions	$2,349.6	$2,543.8	+8.2
Mineral production value do	$608.8	$659.7	+8.4
International trade:			
Value of exports through Minnesota do	$385.1	$499.8	+29.8
Value of imports through Minnesota do	$696.2	$900.6	+29.4

e Estimated. p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; Highlights of U.S. Export and Import Trade; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	8,094	319	2,585	20,683	--	92	4.45	423
Nonmetal	205	202	41	328	1	11	36.58	18,396
Sand and gravel	2,734	162	442	3,536	--	73	20.65	438
Stone	1,221	227	278	2,414	--	99	41.01	1,014
Total	12,254	273	[1] 3,347	26,961	1	275	10.24	697
1972:[2]								
Metal	7,530	323	2,432	19,469	1	80	4.16	551
Nonmetal	155	213	33	262	--	12	45.77	202
Sand and gravel	1,215	136	165	1,469	--	37	25.18	444
Stone	815	195	159	1,334	1	43	33.00	5,126
Total	9,715	287	2,789	22,534	2	172	7.72	811

[1] Data does not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

METALS

Copper-Nickel.—Exploration, including drilling and geologic mapping, for copper-nickel and other base metal sulfide deposits continued in the Duluth Complex and in the Precambrian greenstone belts. Both the State and exploration arms of mining companies were active in the areas, and the Federal Bureau of Mines had metallurgical research on the nickel-copper ores underway. This included detailed petrographic studies of drill cores to determine mineral identity and paragenetic relationships in ore and nonore zones and development of a flowsheet applicable to the potential ores. Processes under investigation included flotation, roasting, leaching, and magnetic separation.

Some were fearful that mining would start immediately with disastrous environmental consequences, and others were afraid that the deposits would be overlooked with resultant loss of employment opportunities and tax revenues. Early in the year the Governor of the State created a task force to study and report on the potential of copper-nickel developments in the State and on potentially detrimental effects of copper-nickel mining and smelting. The task force reported that Minnesota is on the "threshold of a new major industry; that of copper-nickel and associated mineral development." It emphasized that State policy remained adamant against any mining in the Boundary Waters Canoe Area. Dr. Paul Sims, Director of the Minnesota Geological Survey, estimated that over 1 billion tons of material containing more than 0.5% combined copper and nickel were in the Duluth Complex in the areas southeast of Ely alone.[2]

Iron Ore.—Production of iron ore in Minnesota totaled 49 million long tons. It consisted of 34.5 million tons of taconite pellets and 14.5 million tons of natural ore concentrates. The 49 million tons produced constituted 65% of total U.S. production and 39% of total U.S. consumption (domestic and foreign). Comparable 1971 percentages were 63% of U.S. production and 43% of U.S. consumption. Total value of iron ore shipped from Minnesota was $601.9, compared with $547.6 million in 1971. Production from natural ore decreased 17% from that of 1971; that from taconite increased 2%. All production came from open pits.

With ever larger proportions of Minnesota's iron ore production coming from taconite (71% of the total in 1972), quality of Minnesota ore continued to rise. The average grade in 1972 was 60.2% iron, the highest ever. The startup of United States Steel Corp.'s expansion to its Minntac plant in midyear made production capacity of Minnesota's six taconite plants over 40 million long tons per year. Annual production capacities of the six taconite plants at yearend were approximately as follows, in million tons:

United States Steel Corp., Minntac Plant	12
Reserve Mining Co., E. W. Davis Works	10 –11
Pickands Mather & Co., Hoyt Lakes Plant	10 –11
Itasca Pellet Co. & Inland Steel Co., Butler Taconite Plant	2.5– 3
National Steel Co. & Hanna Mining Co., National Steel Plant	2.5– 3
Eveleth Taconite Co., Fairlane Plant	2 – 2.5

Reserves sufficient to sustain several additional taconite plants have apparently been delineated, the plans for their mining and concentrating awaiting only favorable economic conditions. Equipment used at a typical Mesabi Range taconite operation in 1972 included 12- to 14-cubic-yard electric shovels, 85- to 120-ton trucks, and jet piercers and/or rotary drills for making 9- to 12-inch diameter blast holes. The trend towards increasingly larger equipment continued.

Increased concern about the environment spurred operating companies to increase the emphasis on minimizing environmental consequences of large-scale mining and concentrating operations. Although mining companies had been planting trees and shrubs on waste piles and seeding natural ore tailings ponds with success for many years, they were apparently having some difficulties establishing growth on taconite tailings. Therefore, experimentation was being directed towards taconite wastes—establishing growth on tailings and decreasing dust emissions from beneficiation plants. The controversy concerning Reserve Mining Co.'s tailings discharge into Lake Superior, which started in 1968, continued and at yearend was still unresolved. Both the Federal Environmental Protection Agency and the Minnesota Pollution Control Agency continued legal procedures directed towards obtaining cessation of the tailings discharge into the lake. Although some viewed the environmental impact of the tailings with alarm, others supported Reserve's stand and pointed out the importance of Reserve to the economy of the region and claimed the tailings discharge had only minimal effect on the lake.

Production from natural iron ore continued to decline, the 14.5 million tons produced in 1972 were 17% below those produced in 1971, and the lowest since 1938. Largest producer of natural ore continued to be the United States Steel Corp. which operated the Stephens, Rouchleau, and Sherman mines in St. Louis County and the Plummer mine in Itasca County. Jones & Laughlin Steel Corp. produced large tonnages from its McKinley mine in St. Louis County and from its Hill Annex and Lind-Greenway mines in Itasca County.

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[2] Lawver, J. E. Annual Report of Mineral Resources Research Center, 1971–72. Univ. Minn. 1972, 44 pp.

The Hanna Mining Co. continued to operate its Pierce mine in St. Louis County and produced significant tonnages of natural ore concentrates. Pickands Mather & Co.'s only natural ore producer was the Mahoning mine in St. Louis County. It continued to be a large producer. The Cleveland Cliffs Iron Co. operated its Canisteo group of mines in Itasca County. Rhude and Fryberger, Inc. produced small tonnages from the Gross Nelson and Hull Rust mines.

Lower lake value of taconite pellets in 1972 was $0.28 per iron unit, the same as the year before. The base Lake Erie price of Mesabi Bessemer ore was also unchanged from its 1971 price of $11.32 per long ton.

Almost all iron ore shipments continued via the rail-vessel system inaugurated before the turn of the century; that is, by rail from mines and concentrators to ports on Lake Superior and thence by vessel to lower ports on Lakes Michigan, Huron, Erie, or other connected waterways. Where the consuming furnaces are not on the waterways, the ore was further transferred and delivered to the consuming furnace by rail.

For the sixth consecutive year, a new record was established for the latest closing of the iron ore shipping season on the Great Lakes, February 7, 1973. The sinking in early June of the bulk carrier *Sidney Smith* in the St. Clair River had a drastic effect on lake shipping by forcing one-way movement in the river. According to reports, this caused an average 8-hour delay per ship per trip and thereby disrupted shipping schedules. A 43-day work stoppage at Hanna Mining Co. operations in midsummer further delayed iron ore shipments. With several large shippers requesting extension of the shipping season, the Coast Guard used heavy ice breakers and several tugs to help keep open the waterways. The Corps of Engineers, in cooperation with other participating agencies, operated the second of a 3-year action program authorized by the River and Harbor Act of 1970. The Act authorized expenditure of $6.5 million to survey the feasibility of methods for extending the navigation season on the Great Lakes and Saint Lawrence Seaway and to demonstrate the practicability of extending the shipping season. United States Steel Corp. outfitted its bulk carrier, the *Leon Fraser*, with equipment to study transportation problems in ice-covered water. The equipment included instrumentation for measuring ice forces on the ship's hull and an air-bubbling system designed to reduce the resistance of the ship when moving through ice.

Both of the large ore carriers under construction in 1971 were placed in operation during the 1972 shipping season. Bethlehem Steel Corp.'s 52,400-gross-ton *Stewart J. Cort* started transporting taconite pellets from Taconite Harbor, Minn., to Burns Harbors, Ind., on May 1; and United States Steel Corp.'s 45,000-gross-ton *Roger M. Blough* started carrying pellets from Two Harbors, Minn., to Gary, Ind., in mid-June.

Published rail and vessel iron ore freight rates from the Mesabi Range to Lower Lake Ports in effect at the start of the 1972 shipping season totaled $4.64 per ton, the same as the year before. This price included a dock handling charge of $0.26 and a hold of vessel-to-rail-of-vessel charge of $0.30 per ton. Some published volume rates totaled somewhat less than $4.64.

The U.S. Bureau of Mines continued researching ways to improve beneficiation of iron ores at its Twin Cities Metallurgy Research Center. This included investigation of methods to upgrade and improve pellets, and roasting and flotation of iron ores. A new research project was initiated on developing a prototype chemical analysis system for onstream determinations of iron and silicon in iron ore slurries, using gamma rays resulting from neutron capture reactions.

The Mineral Resources Research Center at the University of Minnesota reported on progress in its research on production of super iron ore concentrates, agglomeration of iron ores, computer control of grinding and sizing circuits for processing magnetic taconite and on its reduction-oxidation process for treating taconite. Late in the year J. E. Lawver, director of the Center, reported the intention of the center to concentrate funds and effort on the development of a process for direct reduction of lime-fluxed pellets.

During the year the Bureau of Mines demonstration project near Keewatin was turned over to the General Services Administration as excess property for disposal. The agency then sold the property for salvage. The plant had been designed to test technical and economic feasibility of ways to concentrate nonmagnetic taconite and other low-grade iron ores. Construction of the plant started in 1967 but was halted when funds were needed more urgently elsewhere.

Iron and Steel.—United States Steel Corp.'s Duluth Works continued as the major steel operation in the State. The plant still had a payroll of about 900 employees after the shutdown of its blast furnaces and open hearths in 1971. The corporation continued to operate its coke ovens, rod, merchant bar, wire mills, and fence post fabrication facilities. Semifinished steel for the operation was being supplied by other United States Steel Corp. plants. North Star Steel Co., Minnesota's only other steel mill, continued to produce steel from scrap in its two 65-ton electric furnaces in St. Paul.

Table 5.—Minnesota: Iron ore [1] data, in 1972, by county and range

(Thousand long tons)

County and range	Crude Ore [2]	Usable ore				
	Production	Stocks Jan. 1	Production	Iron content of production	Shipments	Stocks Dec. 31
County:						
Crow Wing	--	W	--	--	W	W
Itasca	19,195	844	6,816	4,104	7,257	403
St. Louis [3]	106,904	6,793	42,182	25,391	43,337	5,638
Total [4]	126,099	7,638	48,998	29,496	50,595	6,041
Range:						
Cuyuna	--	W	--	--	W	W
Mesabi [5]	126,099	7,638	48,998	29,496	50,595	6,041
Total	126,099	7,638	48,998	29,496	50,595	6,041

W Withheld to avoid disclosing individual company confidential data; included with Itasca County.

[1] Exclusive of ore containing 5% or more manganese.

[2] Entire production from open pit mines.

[3] Includes Lake County.

[4] Data may not add to totals shown because of independent rounding.

[5] Includes small quantities from Cuyuna Range in Crow Wing County.

Table 6.—Minnesota: Usable iron ore [1] produced (direct-shipping and all forms of concentrate), by range

(Thousand long tons)

Year	Cuyuna	Mesabi	Vermilion	Spring Valley District	Total
1884-1967	69,375	2,613,766	108,527	8,067	2,794,735
1968	961	51,411	--	83	52,454
1969	--	55,275	--	--	55,275
1970	--	56,073	--	--	56,073
1971	--	51,283	--	--	51,283
1972	--	48,998	--	--	48,998
Total	70,336	2,876,806	108,527	8,150	3,058,819

[1] Exclusive, after 1905, of iron ore containing 5% or more manganese.

Table 7.—Minnesota: Production of usable iron ore

(Thousand long tons)

Year	Natural ore			Taconite	Total Usable ore	Iron content (percent)
	Direct shipping ore	Concentrates	Total	Pellets		
1968	5,002	17,197	22,199	30,255	52,454	58.33
1969	5,461	16,433	21,894	33,381	55,275	58.90
1970	3,892	16,836	20,728	35,345	56,073	58.76
1971	3,335	14,178	17,513	33,771	[1] 51,283	59.89
1972	W	W	14,452	34,546	48,998	60.20

W Withheld to avoid disclosing company confidential data, included in "Total."

[1] Data does not add to total shown because of independent rounding.

Table 8.—Minnesota: Shipments of iron ore [1] from mines

(Thousand long tons)

Year	Natural ore			Taconite	Total usable ore [3]	Proportion of taconite pellets to total usable ore (percent)
	Direct shipping ore [2]	Concentrates	Total	Pellets		
1968	5,044	16,481	21,525	29,751	51,275	58.02
1969	5,461	17,802	23,263	33,693	56,957	59.16
1970	3,892	16,965	20,857	33,935	54,791	61.93
1971	3,335	13,100	16,435	32,619	49,054	66.50
1972	W	W	15,229	35,366	50,595	69.90

W Withheld to avoid disclosing individual company confidential data, included in "Total."

[1] Exclusive of ore containing 5% or more manganese.

[2] Includes crushed, screened, and sized ore not further treated.

[3] Data may not add to totals shown because of independent rounding.

Table 9.—Dates of first and final cargoes of iron ore at Minnesota and Wisconsin upper Great Lakes

Port and dock	1971		1972	
	First	Final	First	Final
Duluth, Minn.: DM&IR	Apr. 8	Dec. 18	Apr. 13	Dec. 22
Silver Bay, Minn.: Reserve	Apr. 11	Dec. 17	Apr. 19	Dec. 29
Superior, Wis.: Burlington Northern	Apr. 12	Dec. 22	Apr. 24	Jan. 1 [2]
Taconite Harbor, Minn.: Erie	Apr. 14	Dec. 8	Apr. 21	Jan. 1 [2]
Two Harbors, Minn.: DM&IR	Apr. 10	Jan. 30 [1]	Apr. 16	Feb. 7 [2]

[1] 1972.

[2] 1973.

Source: Skillings' Mining Review.

Manganiferous Ore.—Hanna Mining Co. and Pittsburgh Pacific Co. reported small shipments of ferruginous manganese ore (ore containing 10% to 35% manganese) from stockpiles on the Cuyuna Range. However, there was no production of ferruginous manganese ore or manganiferous iron ore (ore containing 5% to 10% manganese) reported in Minnesota in 1972, and the outlook for future production was not optimistic. Production of manganese containing ores had been almost continuous since 1913, when the first 27,000 long tons were produced from the Cuyuna Range. In 1942 production reached almost 2 million tons. The 1.5 million tons shipped that year also remained the largest on record. Thereafter, shipments averaged somewhat over 1 million tons per year until 1948 and then declined so that they were generally between 0.5 million and 1.0 million tons until 1957. Since then, manganiferous ore shipments were almost always less than 0.5 million tons. When the mining of nonmanganiferous iron ores stopped in 1968, the continued production of manganiferous ores also became doubtful. Indications are that they cannot be mined profitably unless mined in conjunction with iron ore because of the small tonnage demand for Cuyuna manganiferous ores. By the end of 1972 almost 36 million long tons of manganiferous ore had been shipped from the Cuyuna Range.

Table 10.—Minnesota: Shipments of usable [1] manganiferous iron ore and ferruginous manganese ore from mines in the Cuyuna Range

Year	Manganiferous iron ore (5% to 10% Mn, natural)			Ferruginous manganese ore (10% to 35% Mn, natural)			Total shipments (long tons)
	Shipments (long tons)	Contents (natural)		Shipments (long tons)	Contents (natural)		
		Fe (percent)	Mn (percent)		Fe (percent)	Mn (percent)	
1968	1,596	39.89	6.88	169,695	33.15	14.23	171,291
1969	50	40.37	7.44	340,567	29.73	14.29	340,617
1970	--	--	--	286,996	29.96	13.97	286,996
1971	--	--	--	151,547	28.16	13.56	151,547
1972	--	--	--	106,539	27.09	12.64	106,539

[1] Direct-shipping and beneficiated ore.

NONMETALS

Abrasive Stone.—Jasper Stone Co. continued to produce grinding pebbles from its quartzite deposit near Jasper in Rock County. Output increased 41% over that of 1971. Its value increased 49%. Production accounted for less than 1% of the State mineral output value.

Cement.—Universal Atlas Cement Division of United States Steel Corp. continued as the only cement producer in the State. It produced portland and masonry cement at Duluth from slag, limestone, sand, gypsum, iron dust, and air-entraining compounds. Principal market for the cement was in Minnesota and delivery was mostly in bulk by truck. The firm employs about 150 workers. According to the company, the installation of a new electrostatic precipitator has made dust collection about 99% efficient and smokestack emissions negligible. Cost of the pollution control equipment together with that installed at its nearby steelplant was said to be in excess of $1 million. The deadline to achieve maximum dust collection efficiency set by the Minnesota Pollution Control Agency was extended until 1974. Terms set by the extension require the corporation to give public notice, by July 1973, as to whether the plant will continue to operate; they also set an upper limit of 125 pounds per hour for allowable dust emission by the plant.

Clays.—Production of common clay and shale during 1972 totaled 167,000 short tons. Its value was reported as $251,000. The production was 25% below that of 1971. Most of the clay was used in the production of lightweight aggregate and brick, but small quantities were for use in manufacturing floor and wall tile.

Gem Stones.—Agates and similar semiprecious gem stones gathered by amateur collectors accounted for all State gem stone production.

Lime.—Minnesota quicklime and hydrated lime production decreased 45% in quantity and 36% in value. The only producers were American Crystal Sugar Co. and Cutler-Magner Co. All production by American Crystal Sugar Co. was for its own use in sugar refining. The Cutler-Magner Co. plant at Duluth burned Michigan limestone in a rotary kiln using coal as fuel. Its production was sold for chemical and industrial purposes, principally for papermaking and as mason's lime. The company ceased operation in midyear.

Perlite.—Zonolite Division of W. R. Grace & Co. produced expanded perlite in Minneapolis from material mined outside the State. It was Minnesota's only expanded perlite producer. The perlite was used for plaster and concrete aggregate, insulation, and horticultural purposes.

Sand and Gravel.—Production of sand and gravel in Minnesota in 1972 totaled 36,792,000 short tons. It was valued at $33,454,000. Compared with 1971, production was down 18% and value was down 11%. Sand and gravel accounted for about 5% of the State's mineral production value. It was outranked both in quantity and value only by iron ore. Average value was $0.91 per ton, compared with $0.84 per ton in 1971.

Table 11.—Minnesota: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	4,458	4,075	5,814	5,512
Fill	1,240	922	1,053	714
Paving	5,217	4,256	2,746	2,435
Railroad ballast	93	63	33	29
Other uses [1]	758	1,623	825	1,659
Total [2]	11,765	10,940	10,471	10,349
Gravel:				
Building	4,502	6,324	4,697	7,290
Fill	2,392	706	1,941	574
Paving	15,907	13,700	12,166	10,483
Railroad ballast	201	194	110	105
Miscellaneous	186	190	775	921
Other uses	982	1,060	291	251
Total	24,170	22,174	19,980	19,624
Government-and-contractor operations:				
Sand:				
Building	--	--	3	1
Fill	461	155	369	137
Paving	1,692	1,020	311	270
Other uses	56	38	189	94
Total [2]	2,210	1,213	822	502
Gravel:				
Building	679	387	36	18
Fill	204	89	387	161
Paving	5,862	2,841	4,883	2,707
Other uses	25	2	213	94
Total	6,770	3,319	5,519	2,980
Total sand and gravel [2]	44,916	37,645	36,792	33,454

[1] Includes engine, filler, foundry, glass, molding, oil (hydrafrac), and other sands.

[2] Data may not add to totals shown because of independent rounding.

Table 12.—Minnesota: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Aitkin	4	54	35	4	117	109
Becker	3	W	W	4	180	117
Benton	5	649	564	8	211	114
Big Stone	4	141	118	1	W	W
Blue Earth	4	746	690	3	380	388
Brown	9	515	317	4	292	W
Carlton	12	699	527	7	438	272
Carver	8	W	W	4	639	484
Cass	8	151	140	8	155	190
Chippewa	9	368	250	3	W	W
Chisago	6	315	193	4	W	W
Clay	10	1,244	1,895	11	1,309	1,889
Clearwater	5	277	219	8	W	W
Cook	2	W	W	1	9	W
Cottonwood	5	246	117	3	W	W
Crow Wing	9	581	501	14	386	360
Dakota	15	3,053	2,550	14	3,141	3,143
Dodge	1	W	W	1	5	6
Douglas	3	W	W	2	122	62
Faribault	6	W	W	1	115	120
Fillmore	4	154	129	3	118	152
Freeborn	16	886	659	3	448	391
Goodhue	9	294	286	7	209	232
Hennepin	28	6,794	4,254	19	5,100	4,273
Isanti	--	15	8	1	50	29
Itasca	10	576	458	11	847	885
Jackson	8	442	255	2	W	W
Kanabec	3	77	88	4	119	75
Kandiyohi	4	W	W	4	304	274
Koochiching	5	W	W	8	W	116
Lac qui Parle	9	223	181	2	W	W
Lake	6	W	W	3	95	80
Lake of the Woods	2	98	66	2	W	W
Le Sueur	4	W	W	6	876	W
Lyon	2	W	W	3	104	90
McLeod	7	W	W	1	47	27
Mahnomen	--	57	6	--	--	--
Marshall	2	348	232	4	209	212
Martin	9	365	211	4	319	300
Mille Lacs	5	W	W	2	W	165
Morrison	2	267	38	2	466	W
Mower	4	W	W	4	412	259
Murray	6	W	W	1	49	7
Nobles	5	231	179	4	252	W
Norman	6	W	W	1	130	96
Olmsted	9	690	592	5	382	372
Otter Tail	6	666	521	8	W	W
Pennington	1	W	W	4	239	122
Pine	5	215	47	3	W	17
Pipestone	6	434	220	2	W	W
Polk	11	881	832	7	813	771
Redwood	5	234	153	3	W	14
Renville	11	589	725	6	316	287
Rice	4	676	614	4	280	W
Rock	5	362	374	2	W	48
Roseau	6	W	W	6	114	59
St. Louis	40	4,360	3,262	27	1,722	1,402
Scott	4	W	W	4	279	W
Sherburne	7	622	687	6	785	931
Sibley	1	71	84	--	--	--
Stearns	7	358	548	4	303	56
Steele	5	366	493	7	348	537
Stevens	3	580	431	1	W	W
Swift	1	W	W	3	62	W
Todd	5	W	W	3	287	W
Wabasha	4	108	100	2	W	W
Wadena	1	54	8	2	W	W
Waseca	1	31	W	1	W	W
Washington	14	2,960	3,436	16	2,559	3,040
Watonwan	3	W	W	1	54	8
Wright	11	564	430	8	592	610

See footnotes at end of table.

Table 12.—Minnesota: Sand and gravel sold or used by producers, by county—Continued

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Yellow Medicine	8	W	W	5	135	124
Undistributed [1]	[r]41	9,823	9,025	44	9,918	10,145
Total [2]	504	44,916	37,645	375	36,792	33,454

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Anoka (1972), Beltrami, Grant, Houston, Hubbard (1971), Kittson, Lincoln, Meeker, Nicollet, Pope, Ramsey, Red Lake, Traverse, Wilkin, and Winona (1971) Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Stone.—Value of all stone produced in Minnesota in 1972 was $16,318,000, up 14% from that of 1971. Stone ranked third in value of State mineral production accounting for about 2.5% of total value.

Limestone and dolomite accounted for 84% of total stone output, and 52% of total stone value. Principal production was as crushed rock. However, the 0.3% produced as dimension stone was worth 15% of total limestone and dolomite value.

Most of the granite quarried in Minnesota was for use as crushed rock. Minor quantities of basalt, quartzite, and marl are included in total stone statistics. All basalt and most of the quartzite were used as aggregate or riprap.

Late in the year, Rembrandt Enterprises, a Minneapolis-based diversified corporation, entered into an agreement, subject to approval by its board of directors, to purchase all outstanding shares of Delano Granite, Inc. Delano Granite operates three quarries in Minnesota and one in Milbank, S. Dak. It also has granite deposits in Barre, Vt., Wausau, Wis., and Perris, Calif. Its subsidiary, Granite City Granite Co., St. Cloud, Minn., is wholly owned on the manufacturing level; its Braham Monument Co., Braham, Minn., also a wholly owned subsidiary, manufactures and retails granite products.

Table 13.—Minnesota: Limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension:				
Rough architectural [1] thousand cubic feet	18	94	24	79
Cut stone do	72	1,275	43	777
House stone veneer [2] do	68	307	98	480
Total (thousand short tons)	13	[3]1,677	13	[3]1,285
Crushed and broken:				
Bituminous aggregate	187	247	224	284
Concrete aggregate	W	W	262	420
Dense graded road base stone	2,332	3,227	2,819	4,102
Macadam aggregate	152	228	237	324
Surface treatment aggregate	322	496	636	866
Unspecified construction aggregate and road stone	682	773	82	114
Agricultural limestone	241	491	231	454
Riprap and jetty stone	32	68	40	49
Other [4]	1,191	2,014	293	578
Total [3]	5,138	7,544	4,825	7,190
Grand total [3]	5,151	9,220	4,838	8,475

W Withheld to avoid disclosing individual company confidential data; included in "Other."

[1] Data include irregular shaped stone, rubble, and rough flagging (1971).

[2] Includes sawed stone, dressed flagging, and monumental (1972).

[3] Data may not add to total shown because of independent rounding.

[4] Data include stone used for flux (1971) poultry grit (1971), roofing aggregate (1972), other filler, railroad ballast, and uses not specified.

Table 14.—Minnesota: Granite sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Dimension:				
Rough architectural……thousand cubic feet	8	47	W	W
Rough monumental……do	35	118	W	W
Dressed architectural (cut)……do	209	3,131	196	W
Dressed monumental……do	3	115	W	W
Total……thousand short tons	22	3,411	22	W
Crushed and broken:				
Poultry grit	W	W	7	W
Aggregate and roadstone	103	155	W	W
Railroad ballast	335	510	195	300
Riprap and jetty stone	2	3	W	W
Other [1]	7	108	--	--
Total	447	[2] 775	W	W
Grand total	469	[2] 4,187	W	W

W Withheld to avoid disclosing individual company confidential data.

[1] Includes uses not specified.

[2] Data does not add to totals shown because of independent rounding.

Table 15.—Minnesota: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971 Number of quarries	1971 Quantity	1971 Value	1972 Number of quarries	1972 Quantity	1972 Value	Kind of stone produced in 1972 [1]
Benton	1	W	W	--	--	--	
Big Stone	1	W	W	1	(2)	W	Granite.
Blue Earth	4	W	971	3	W	1,009	Limestone.
Carver	1	W	W	--	--	--	Do.
Dakota	1	W	W	1	W	W	Do.
Dodge	3	73	91	3	W	W	Do.
Fillmore	11	366	643	6	280	454	Do.
Goodhue	7	164	201	4	W	W	Do.
Hennepin	2	W	W	1	31	W	Do.
Houston	14	252	336	12	W	W	Do.
Lac qui Parle	3	2	300	3	W	W	Granite.
Le Sueur	3	W	W	3	29	727	Limestone, quartzite.
Mille Lacs	1	W	W	1	1	W	Granite.
Mower	4	W	W	2	W	W	Limestone.
Nicollet	1	W	W	1	W	W	Quartzite.
Olmsted	8	W	W	12	W	W	Limestone.
Redwood	2	W	W	2	W	W	Granite.
Renville	1	W	W	1	1	W	Do.
Rice	2	W	W	1	W	W	Limestone.
Rock	1	W	W	1	W	W	Quartzite.
St. Louis	3	W	W	7	115	327	Traprock, other stone.
Scott	4	593	1,179	4	770	1,393	Limestone.
Stearns	10	W	W	8	W	W	Granite.
Steele	1	W	W	1	W	W	Limestone.
Wabasha	3	W	W	2	W	W	Do.
Wadena	1	W	W	1	W	W	Marl.
Washington	3	W	W	3	W	W	Limestone.
Winona	7	W	927	5	W	W	Do.
Wright	--	--	--	1	W	W	Other stone.
Yellow Medicine	1	195	300	1	195	300	Granite.
Undistributed	--	4,192	9,398	--	4,334	12,108	
Total [3]	104	5,838	14,346	91	5,757	16,318	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] "Limestone" used generally to include dolomite.

[2] Less than ½ unit.

[3] Data may not add to totals shown because of independent rounding.

Sulfur.—Great Northern Oil Co. and Northwestern Refining Co. continued recovering sulfur as a byproduct from their petroleum refining operations near Pine Bend, Dakota County, and St. Paul Park, Washington County, respectively.

Vermiculite.—Three Twin Cities firms produced exfoliated vermiculite from material shipped from outside the State. The expanded vermiculite was sold for use principally as aggregate in lightweight plaster and concrete.

MINERAL FUELS

Peat.—Three companies reported peat production in Minnesota in 1972. It consisted principally of moss and reed-sedge peat used in general soil improvement and in potting soils. Most was sold in packaged form, but some minor quantities were sold in bulk. Although Minnesota has 50% of the Nation's known peat supply, it produces only a very small fraction of total U.S. production. It accounts for less than 1% of State mineral production value.

Table 16.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasive stone—Grinding pebbles and tube-mill liners:			
Jasper Stone Co.	Box 206 Sioux City, Iowa 51102	Quarry and processing plant	Rock.
Cement:			
Universal Atlas Cement Division United States Steel Corp.	Chatham Center, Box 2969 Pittsburgh, Pa. 15230	Portland and masonry, wet process	St. Louis.
Clays and shale:			
North Central Lightweight Aggregate Co., Inc.	4901 West Medicine Lake Dr. Minneapolis, Minn. 55427	Pit and plant	Hennepin.
Ochs Brick & Tile Co.	Springfield, Minn. 56087	Pits and plant	Brown, Redwood.
Twin City Brick Co.	790 Joy Ave. St. Paul, Minn. 55118	Pit and plant	Ramsey.
Coke:			
American Steel & Wire Division, United States Steel Corp.	Morgan Park Duluth, Minn. 55800	Coke ovens	St. Louis.
Koppers Co., Inc.	1000 Hamline Ave., North St. Paul, Minn. 55104	do	Ramsey.
Iron ore:			
Cleveland-Cliffs Iron Co.:	1460 Union Commerce Bldg. Cleveland, Ohio 44115		
Canisteo and Hill Trumbull		Mines and concentrators	Itasca.
The Hanna Mining Co.:	100 Erieview Plaza Cleveland, Ohio 44114		
Rabbit Lake		Stockpile shipments	Crow Wing.
Butler Taconite Project		Mine, concentrator, and agglomerator	Itasca.
National Steel Pellet Project		do	Itasca, St. Louis.
Pierce Group		Mine and concentrator	St. Louis.
South Agnew Group		Stockpile shipments	Do.
West Hill		do	Itasca.
Jones & Laughlin Steel Corp., Minnesota Ore Division:	Virginia, Minn. 55792		
Hill Annex and Lind-Greenway		Mines and concentrators	Do.
McKinley and Schley Group		Mine and concentrator	St. Louis.
Oglebay Norton Co.:	Hanna Bldg. Cleveland, Ohio 44115		
Thunderbird Mine		Mine: Ore treated at Fairlane Plant	Do.
Fairlane Plant		Concentrator and agglomerator	Do.
Pickands Mather & Co.:	1100 Superior Ave. Cleveland, Ohio 44114		
Erie Commercial		Mine, concentrator, and agglomerator	Do.
Mahoning		Mine and concentrator	Do.
Pittsburgh Pacific Co.:	2521 First Ave. Hibbing, Minn. 55746		
Dunwoody, Gilbert, Monroe, and others		Ore treated at Coons Pacific Plant	Do.
Julia Plant		Concentrator	Do.
Reserve Mining Co.:	Silver Bay, Minn. 55614		
Peter Mitchell		Mine and primary crushing	Do.
E. W. Davis Works		Concentrator and agglomerator	Lake.

Rhude & Fryberger, Inc.:	Box 66 Hibbing, Minn. 55746		
Gross Nelson and Hull-Rust Group		Mines and concentrators	St. Louis.
United States Steel Corp., Minnesota Ore Operations:	Box 417 Mountain Iron, Minn. 55768		
Plummer Group		Mine and concentrator	Itasca.
Kosmerl		Mined by Snyder Mining Co. in conjunction with Whiteside Mine.	St. Louis.
Minntac		Mine, concentrator, and agglomerator	Do.
Rouchleau Group		Ore treated at Julia Plant	Do.
Sherman Group		Mine and concentrator	Do.
Stephens Mine		do	Do.
Iron and steel:			
North Star Steel Co	1400 Red Rock Rd., St. Paul, Minn. 55119	Electric steel furnace	Ramsey.
Secondary lead smelters:			
Gopher Smelting & Refining Co	33855 S. Highway 49 St. Paul, Minn. 55111	Processing plant	Daokta.
N L Industries, Inc	111 Broadway New York, N.Y. 10006	do	Hennepin.
Lime:			
American Crystal Sugar Co	Boston Bldg. Denver, Colo. 80201	Quicklime, shaft kilns	Carver, Clay, Polk.
Cutler-Magner Co	12th Ave. & Waterfront Duluth, Minn. 55802	Quicklime and hydrated lime, one rotary kiln.	St. Louis.
Manganiferous ore:			
The Hanna Mining Co.:	100 Erieview Plaza Cleveland, Ohio 44114		
Lauretta		Stockpile shipments	Crow Wing.
Pittsburgh Pacific Co.:	2521 First Ave. Hibbing, Minn. 55746		
Louise and Mangan No. 1		do	Do.
Peat:			
Power-O-Peat Co	Gilbert, Minn. 55741	Peat bog	St. Louis.
Red Wing Peat Corp	Box 3006 Houston, Tex. 77001	do	Carlton.
Expanded perlite:			
Zonolite Division, W. R. Grace & Co	62 Whittemore Ave. Cambridge, Mass. 01109	Processing plant	Hennepin.
Sand and gravel:			
Alexander Construction Co., Inc	4641 Hiawatha Ave. Minneapolis, Minn. 55406	Pits and portable plants	Dakota, Hennepin, Washington.
Anderson Aggregates, Inc	100 North Seventh St. Minneapolis, Minn. 55403	Pit; one stationary, one portable plant	Hennepin.
Barton Contracting Co	10300 89th Ave., North Osseo, Minn. 55369	Pits and stationary plants	Carlton, Chisago, Dakota, Hennepin, Sherburne, Washington.
Cemstone Products Co	1520 E. Minnehaha Ave. St. Paul, Minn. 55106	Portable plant	Washington.
J. A. Danens & Sons, Inc	7175 Cahill Rd. Minneapolis, Minn. 55435	(Type not available)	Hennepin.
Duininck Bros. & Gilchrist	Olivia, Minn. 56277	Pits and portable plants	Big Stone, Carlton, Clearwater, Kandiyohi, Kittson, Marshall, Polk, Redwood, Renville, Roseau.
Fisher Sand & Aggregates	Rosemount, Minn. 55068	Stationary plant	Dakota.
C. McCrossan, Inc	Box 322, Osseo, Minn. 55369	do	Hennepin.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
Mark Sand & Gravel Co	Box 396, Fergus Falls, Minn. 56537	Pits and portable plants	Clay, Clearwater, Douglas, Grant, Mahnomen, Norman, Otter Tail, Wilkin.
J. L. Shiely Co	1101 North Snelling Ave. St. Paul, Minn. 55108	Pit and stationary plant	Washington.
Ulland Brothers, Inc	Box 98 Austin, Minn. 55912	Pits and portable plants	Freeborn, Mower, Olmsted Steele.
Do	Box 340 Cloquet, Minn. 55720	do	Carlton, Cook, Lake, St. Louis.
Stone:			
Granite:			
Cold Spring Granite Co	Cold Spring, Minn. 56320	Quarries	Big Stone, Lac qui Parle, Mille Lacs, Renville.
Do	do	Quarries and stationary plants	Stearns.
Delano Granite, Inc	Delano, Minn. 55328	Quarries	Lac qui Parle, Stearns.
Do	do	Stationary plant	Wright.
The Green Co	Granite Falls, Minn. 56241	Quarry and stationary plant	Yellow Medicine.
Shiely-Petters Crushed Stone Co., Inc.	Box 69, St. Cloud, Minn. 56301	do	Stearns.
Limestone and dolomite:			
Bryan Rock Products, Inc	Box 215, Shakopee, Minn. 55379	Quarries; stationary and portable plants	Scott, Washington.
Hector Construction Co., Inc	Box 410, Caledonia, Minn. 55921	Quarries and portable plants	Houston, Winona.
Edward Kraemer & Sons, Inc	Plain, Wis. 53577	Quarry and stationary plant	Dakota.
Lundin Construction Co	1905 Third Ave., Mankato, Minn. 56001	Quarry	Blue Earth.
Mankato Ag Lime & Rock Co	Route 3, Mankato, Minn. 56001	Quarry and stationary plant	Do.
Osmundson Brothers	Adams, Minn. 55909	Quarries and portable plant	Mower.
Quarve & Anderson Co	Route 3, Box 27, Rochester, Minn. 55901	Quarries and portable plants	Dodge, Olmsted, Wabasha, Winona.
River Warren Aggregates, Inc	Lakeville, Minn. 55074	do	Scott.
Roverud Construction, Inc	159 W. Main St., Spring Grove, Minn. 55974	Quarries	Lake.
J. L. Shiely Co	1101 North Snelling Ave., St. Paul, Minn. 55108	Quarries and stationary plants	Scott, Washington.
Stussy Construction Co	Mantorville, Minn. 55955	Quarry	Dodge.
Marl:			
Richard Nanik Marl Pit	Star Route, Staples, Minn. 56479	Pit	Wadena.
Quartzite:			
Jasper Stone Co	Box 206, Sioux City, Iowa 51102	Quarry and stationary plant	Rock.
New Ulm Quartzite Quarries, Inc	New Ulm, Minn. 56073	do	Nicollet.
Traprock (Basalt):			
Arrowhead Blacktop Co	14th Ave. West & Waterfront, Duluth, Minn. 55802	Pit	St. Louis.
Sulfur (recovered):			
Koch Refining Co	Box 3596, St. Paul, Minn. 55101	Elemental sulfur recovered as a byproduct of oil refining.	Dakota.
Northwestern Refining Co	P.O. Drawer 9, St. Paul Park, Minn. 55071	do	Washington.
Exfoliated vermiculite:			
MacArthur Co	936 Raymond Ave., St. Paul, Minn. 55114	Processing plant	Ramsey.
The B. F. Nelson Manufacturing Co	401 Main St., Northeast, Minneapolis, Minn. 55413	do	Hennepin.
Zonolite Division, W. R. Grace & Co	62 Whittemore Ave., Cambridge, Mass. 01109	do	Do.

The Mineral Industry of Mississippi

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Mississippi Geological, Economic, and Topographical Survey for collecting information on all minerals except fuels.

By C. L. Readling [1] and Alvin R. Bicker, Jr.[2]

Mineral production in Mississippi was valued at nearly $261 million in 1972, approximately $1.5 million less than the 1971 total. Crude petroleum and natural gas constituted 84.6% of the total value. The total production and value of mineral fuels—petroleum, natural gas, and natural gas liquids—declined, but average unit value of natural gas and natural gas liquids each increased in 1972 over that of the previous year. Value of all other mineral production, excluding petroleum and natural gas, increased $4.6 million.

Mississippi Power and Light Co. (MP&L) announced plans to build a nuclear-fueled generating station northwest of Port Gibson in Claiborne County. The facility, a 1,290,000-kilowatt unit, will be known as the Grand Gulf Nuclear Station. A construction permit is expected in 1974. Completion date is targeted for late 1979. Construction continued on schedule on the 750,000-kilowatt Gerald Andrus Steam Electric Station near Greenville and was over 25% complete at the end of the year. The station is the first in the MP&L system designed to use fuel oil as the primary fuel.

Construction continued on Mississippi Power Company's 500,000-kilowatt steam-electric, coal-fired generating unit at Plant Jack Watson, located between Biloxi and Gulfport. When this unit is placed in service during the summer of 1973, the plant's capacity will increase to 1,051,360 kilowatts. Initial construction was also begun on a 500,000-kilowatt steam-electric, oil-fired generating plant on the Pascagoula River in Jackson County to become operational in 1976.

The U.S. Department of the Interior offered for sale on Sepetember 12, 1972, the same 78 tracts for drilling offshore Louisi-

Table 1.—Mineral production in Mississippi [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays .... thousand short tons..	2,278	$8,501	1,919	$7,837
Natural gas .... million cubic feet..	118,805	24,830	103,989	28,077
Petroleum (crude) .... thousand 42-gallon barrels..	64,066	201,808	61,100	192,465
Sand and gravel .... thousand short tons..	11,289	13,526	13,419	16,133
Stone .... do....	[r] 726	[r] 709	1,135	1,199
Value of items that cannot be disclosed: Cement, lime, magnesium compounds, and natural gas liquids....	XX	12,790	XX	14,970
Total	XX	[r] 262,164	XX	260,681
Total 1967 constant dollars	XX	222,918	XX	[p] 216,860

[p] Preliminary. [r] Revised. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

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[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

[2] Economic geologist, Mississippi Geological, Economic, and Topographical Survey, Jackson, Miss.

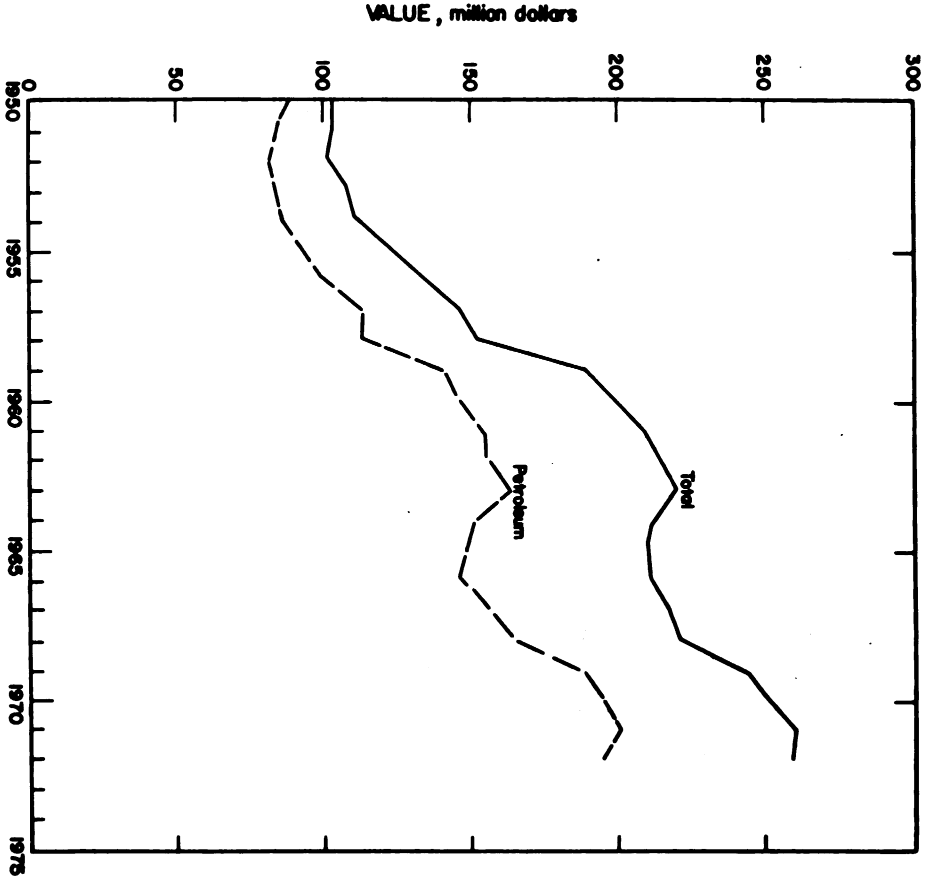

Figure 1.—Value of petroleum and total value of mineral production in Mississippi.

ana that were in the aborted sale scheduled December 21, 1971. Environmental groups which obtained an injunction blocking the December sale planned no further court action on this offering. Though technically off the coast of Louisiana, 25,000 acres lie due south of Mobile, Ala., and 45,000 acres lie south of Mississippi.

Oil- and gas-drilling operations declined in 1972 primarily owing to less development drilling activity in the Eocene Wilcox and Upper Cretaceous trends. Exploratory well-drilling completions increased 18% over those of 1971. The Jurassic trend had significant development drilling in the Pachuta Creek and Prairie Branch fields in Clarke County, and the Lake Utopia field in Jasper County, with four oil wells each. In the Paleozoic area of the Black Warrior Basin, the Corinne field, discovered in 1972, had three gas wells. The most significant development drilling in the Lower Cretaceous was at Davis field, Clarke County. This field, which has multiple pay zones in the Paluxy and Washita-Freder-

Table 2.—Value of mineral production in Mississippi, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	$22,014	$20,179	Petroleum, sand and gravel, natural gas, natural gas liquids.
Alcorn	W	W	Clays.
Amite	5,364	4,722	Petroleum, natural gas.
Attala	W	--	
Bolivar	W	W	Sand and gravel.
Carroll	W	2,008	Sand and gravel, clays.
Clarke	44,119	38,854	Petroleum, natural gas, natural gas liquids.
Clay	682	692	Sand and gravel, stone, natural gas.
Copiah	W	3,014	Sand and gravel.
Covington	920	468	Petroleum, natural gas.
De Soto	W	W	Sand and gravel.
Forrest	3,460	2,790	Natural gas, sand and gravel, petroleum, clays.
Franklin	9,913	7,577	Petroleum, natural gas.
Greene	234	342	Do.
Hancock	270	267	Natural gas, petroleum.
Harrison	W	--	
Hinds	[r] 1,898	1,766	Petroleum, natural gas, clays.
Holmes	376	W	Sand and gravel.
Humphreys	49	57	Petroleum.
Itawamba	W	619	Clays, natural gas, sand and gravel.
Jackson	W	W	Magnesium compounds, lime.
Jasper	26,786	34,525	Petroleum, natural gas, natural gas liquids, clays.
Jefferson	1,220	873	Petroleum, natural gas.
Jefferson Davis	5,985	4,966	Natural gas, petroleum, natural gas liquids.
Jones	11,841	9,969	Petroleum, natural gas, clays, natural gas liquids.
Kemper	--	43	Clays.
Lafayette	W	--	
Lamar	28,436	28,818	Petroleum, natural gas.
Lauderdale	W	W	Clays.
Lee	W	W	Do.
Leflore	W	39	Petroleum, natural gas.
Lincoln	4,777	4,623	Petroleum, natural gas, clays.
Lowndes	W	W	Sand and gravel, clays.
Madison	1,559	1,536	Petroleum, natural gas.
Marion	W	6,883	Natural gas, petroleum, sand and gravel.
Marshall	362	348	Clays.
Monroe	3,280	3,294	Clays, sand and gravel, natural gas.
Noxubee	W	W	Clays, sand and gravel.
Oktibbeha	W	14	Natural gas.
Panola	W	W	Clays, sand and gravel.
Pearl River	649	606	Natural gas, petroleum.
Perry	W	W	Sand and gravel, petroleum.
Pike	2,045	2,040	Petroleum, sand and gravel, natural gas, natural gas liquids.
Pontotoc	W	--	
Prentiss	W	W	Clays.
Rankin	5,344	7,203	Cement, petroleum, natural gas, stone.
Scott	295	231	Petroleum, natural gas.
Simpson	2,018	1,713	Do.
Smith	12,098	10,575	Petroleum, natural gas, natural gas liquids, clays.
Stone	W	W	Sand and gravel.
Sunflower	W	23	Clays.
Tate	W	--	
Tippah	1,760	W	Clays.
Tishomingo	W	W	Sand and gravel.
Union	W	--	
Walthall	8,180	9,697	Natural gas, petroleum.
Warren	8,280	5,730	Cement, sand and gravel, stone.
Washington	W	W	Sand and gravel.
Wayne	16,150	14,110	Petroleum, natural gas.
Wilkinson	6,570	5,140	Do.
Winston	W	59	Clays.
Yalobusha	W	432	Sand and gravel.
Yazoo	9,201	11,385	Petroleum, sand and gravel, natural gas.
Undistributed[2]	21,031	12,459	
Total[3]	[r] 262,164	260,681	

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[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties were not listed because no production was reported: Benton, Calhoun, Chickasaw, Choctaw, Claiborne, Coahoma, George, Grenada, Issaquena, Lawrence, Leake, Montgomery, Neshoba, Newton, Quitman, Sharkey, Tallahatchie, Tunica, and Webster.

[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

icksburg, added six new oil wells during the year. In the Upper Cretaceous, the Gillsburg field in Amite County added seven new oil wells and the Baxterville field in Lamar County developed five new oil wells during 1972. In the Eocene Wilcox, the most active development was at LaGrange field in Adams County, with six new producers.

The Geological Survey, U.S. Department of the Interior, published a report describing the general conditions of ground-water occurrences, availability, and quality in the Pearl River Basin of Mississippi and Louisiana.[3]

Employment.—According to the Mississippi Employment Security Commission, the number of wage-and-salary workers in petroleum production, refining, and related industries increased 2.3%. Average employment in the mining industry remained the same in 1971–72 and continued to be only 1% of the total nonagricultural labor force.

Legislation and Government Programs.—The State Governor in June signed a deed conveying 64,000 acres of submerged lands in Mississippi Sound to the Federal Government to clear the way for the proposed Gulf Islands National Seashore project on three offshore islands. The State reserved the mineral rights. The State also donated the entire 266-acre Magnolia State Park near Biloxi for the National Seashore. The National Park Service plans to initially spend about $7 million in developing the National Seashore on Ship,

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[3] Lang, J. W. Geohydrologic Summary of the Pearl River basin, Mississippi and Louisiana. U.S. Geol. Survey Water Supply Paper 1899–M, 1972, p. M1–M44.

Table 3.—Indicators of Mississippi business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total work force .... thousands..	841.4	864.9	+2.8
Unemployment .... do....	42.0	36.3	−13.6
Employment:			
Construction .... do....	31.7	35.2	+11.0
Mining .... do....	6.1	6.1	--
Manufacturing .... do....	189.1	204.8	+8.3
Other industries [1] .... do....	366.4	383.6	+4.7
Personal income:			
Total .... millions..	$6,273	$6,931	+10.5
Per capita	$2,788	$3,063	+9.9
Construction activity:			
Building permits, total private nonresidential .... millions..	$75.9	$106.9	+40.8
Cement shipments to and within Mississippi ....thousand short tons..	852	1,001	+17.5
Mineral production value .... millions..	r $262.2	$260.7	−0.6

p Preliminary. r Revised.

[1] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; services; and government.

Sources: Survey of Current Business, Construction Review, Employment and Earnings and Annual Report on the Labor Force, Area Trends in Employment and Unemployment and U.S. Bureau of Mines.

Table 4.—Wage-and-salary workers in petroleum production, refining, and related industries

Year	Crude petroleum and natural gas production	Petroleum refining [1]	Pipeline transportation (except natural gas)	Gas utilities	Retail filling stations	Chemicals manufactured as byproducts of petroleum or used in refining of petroleum [2]
1968........	5,482	862	151	2,164	5,144	398
1969........	5,515	864	158	2,141	5,084	417
1970........	5,900	1,000	175	2,158	5,238	424
1971........	5,738	1,059	181	2,187	5,115	411
1972........	5,764	1,038	182	2,225	5,429	397

[1] Employment in petroleum refineries and petrochemicals manufactured in petroleum refineries.

[2] Employment in petrochemical manufacturing facilities located outside petroleum refineries.

Source: Mississippi Employment Security Commission.

Table 5.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Nonmetal	530	240	127	1,028	--	23	22.38	287
Sand and gravel	690	261	180	1,642	--	33	20.09	649
Stone	122	232	28	230	--	--	--	--
Total [1]	1,342	250	336	2,900	--	56	19.31	469
1972: [2]								
Nonmetal	335	240	80	654	--	18	27.52	358
Sand and gravel	405	284	114	1,079	2	23	23.18	14,633
Stone	100	257	25	202	--	1	4.95	2,228
Total [1]	835	268	220	1,935	2	42	22.74	8,512

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

Horn, and Petit Bois Islands. The original legislation authorizing Gulf Islands National Seashore was signed into law by President Nixon on January 8, 1971. The National Seashore will include a series of offshore islands and keys stretching 150 miles from Gulfport, Miss., to Destin, Fla.

The Mississippi legislature enacted new laws authorizing more unitization of oilfields and gasfields in the State and expanding the enforcement authority of the Air and Water Pollution Commission to satisfy Environmental Protection Agency (EPA) standards.

EPA granted interim authority to the State to issue permits for waste discharge into waterways. Only 10 States were granted this authority. The other States are California, Georgia, Iowa, Michigan, Minnesota, Missouri, Ohio, Oregon, and Washington.

Transportation.—Shell Oil Co. completed 58 miles of 12-inch crude oil pipeline from Thomasville, Miss., to Yazoo City, Miss., in April. Tennessee Gas Pipeline Co. obtained approval from the Federal Power Commission to construct 136.2 miles of 36-inch gas pipeline from Bay St. Louis, Miss., to Centerville, Tenn. Completion of the pipeline is scheduled for 1973.

According to the American Gas Association, Inc. (AGA), there were 16,402 miles of utility gas mains in Mississippi at the end of 1972. A total of 363 miles of gas mains were installed during 1972 of which 196 miles were distribution lines, and 166 miles were transmission lines. At the end of 1971 there were 16,148 miles of utility gas mains in Mississippi. There were 3,058 miles of crude-oil and refined-products pipelines in the State as of January 1, 1971, according to the latest Bureau of Mines crude-oil and product pipelines triennial report.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The combined value of crude petroleum and natural gas production decreased $6.1 million in 1972 compared with 1971; a decrease of 2.7%. The combined value of $220.5 million was 84.6% of the total mineral production value compared with 86.4% last year.

Mississippi retained its ninth-place rank in order of total U.S. crude oil production. The State ranked 12th in natural gas production and 17th in natural gas liquids production. Leading counties, in order of mineral fuels value, were Clarke, Jasper, Lamar, Adams, Wayne, Yazoo, and Smith.

The Mississippi State Oil and Gas Board reported two gas and eight new oil field discoveries during the year. One gas discovery and three oil discoveries were productive from Cretaceous age formations. Three oil discoveries were productive from Jurassic age sediments, and two discoveries produced oil from the Wilcox Formation (Tertiary age). The remaining gas discovery, Corinne field, was productive from the Mississippian and Pennsylvania reservoirs.

Cretaceous discoveries were South Williamsburg (Sligo-gas discovery) in Covington County, Cistercian (Hosston) in Jasper County, Camp Shelby (Paluxy) in Perry County, and Hurricane Lake (Tuscaloosa) in Lincoln County. Jurassic discoveries, all productive from the Smackover reservoir, were Lake Como and Vossburg in Jasper County and Pachuta Creek in Clarke County. Wilcox discoveries were Piney Creek and Southeast Darrington, both in Wilkinson County.

According to the Mississippi State Oil and Gas Board, there were 423 oil pools and 70 gas pools in 412 fields productive at yearend. There were 3,447 producible wells, a decline of 1.8% from 3,509 producing wells on December 31, 1971.

Natural Gas.—Marketed natural gas production was 104 billion cubic feet, a decline of 12.5% from the 119 billion cubic feet marketed in 1971. The volume of marketed natural gas production declined for the eighth consecutive year. Total value of marketed natural gas increased 13.1% due to a 29% increase in average wellhead value from 20.9 cents per thousand cubic feet to 27.0 cents per thousand cubic feet in 1972. Mississippi ranked 12th in the Nation in marketed production of natural gas. Six of the 32 gas-producing counties supplied 80.6% of the natural gas

Table 6.—Mississippi: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Adams	24	--	26	--	--	50	100	686,073
Amite	7	--	10	--	--	5	22	247,932
Bolivar	--	--	--	--	--	4	4	27,211
Calhoun	--	--	1	--	--	--	1	3,448
Carroll	--	--	--	--	--	3	3	19,677
Chickasaw	--	--	1	--	--	--	1	2,685
Clarke	16	--	13	1	--	13	43	543,099
Copiah	--	--	--	--	1	--	1	20,721
Covington	--	--	--	--	1	1	2	34,063
Forrest	--	--	1	--	--	1	2	19,010
Franklin	1	--	3	--	--	16	20	136,927
Greene	--	1	--	--	--	--	1	18,237
Hinds	--	--	--	--	--	1	1	18,488
Holmes	--	--	--	--	--	7	7	64,225
Humphreys	--	--	1	--	1	--	2	20,380
Issaquena	--	--	--	--	--	2	2	17,177
Itawamba	--	--	1	--	--	--	1	742
Jasper	14	--	8	3	--	3	28	340,959
Jefferson	--	--	1	--	--	13	14	85,927
Jefferson Davis	--	2	1	--	--	1	4	46,173
Jones	1	--	--	--	--	2	3	40,505
Lafayette	--	--	--	--	--	2	2	7,032
Lamar	5	--	--	--	1	2	8	35,949
Lauderdale	--	--	--	--	--	1	1	6,005
Leflore	--	--	--	--	--	4	4	29,768
Lincoln	1	--	4	2	--	5	12	137,299
Marion	--	1	1	--	--	1	3	37,548
Monroe	--	3	1	--	--	4	8	40,317
Newton	--	--	--	--	--	2	2	23,521
Noxubee	--	--	--	--	--	1	1	8,290
Pearl River	--	--	3	--	--	4	7	65,874
Perry	--	--	1	1	--	3	5	62,336
Pike	--	--	--	--	--	10	10	110,099
Rankin	--	2	--	--	--	3	5	97,522
Scott	--	--	1	--	--	4	5	69,992
Sharkey	--	--	--	--	--	1	1	10,067
Simpson	--	--	--	--	--	2	2	29,779
Smith	2	--	--	--	--	2	4	64,556
Sunflower	--	--	--	--	--	3	3	25,582
Walthall	1	--	2	--	--	1	4	42,473
Washington	--	--	--	--	--	2	2	6,863
Wayne	1	--	--	--	--	7	8	123,721
Wilkinson	4	--	12	2	--	33	51	379,636
Yazoo	1	--	2	--	--	4	7	73,130
Total	78	9	94	9	4	223	417	3,881,018

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

produced in the State. In descending order of production, they were Walthall, Marion, Jefferson Davis, Smith, Jasper, and Forrest.

Natural gas reserves declined for the 11th consecutive year, extending the downward trend that started in 1961. According to the AGA, estimated gas reserves were 1,104.3 billion cubic feet as of December 31, 1972, 1.2% less than that at yearend 1971. The reserve-to-production ratio declined from 16.4:1 in 1961 to 10.6:1 in 1972, up slightly from the 9.4:1 ratio last year.

The Mississippi State Oil and Gas Board reported the discovery of two new gasfields, Corinne field in south Monroe County and South Williamsburg in Covington County. The Corinne discovery well, Ladner and Hildebrand and Gibraltar Oil Corp. No. 1, in Sec. 1-T16S-R7E, Monroe County, was dually completed flowing 1,210,000 cubic feet per day from a Pennsylvanian sandstone and 2,300,000 cubic feet per day from the Sanders sand. The Skelly-Mallard No. 1 J. C. King in Sec. 21-T7N-R16W, Covington County, was completed from the Sligo formation flowing 1,694,000 cubic feet per day of gas and 18 barrels per day of condensate.

Cities Service Oil Co.'s No. A-1 Sanders, Sec. 8-T9N-R7E, Copiah County, was completed in early June from perforations in the Cotton Valley formation. This discovery well in the yet unnamed field yielded a flow rate of 1,064,000 cubic feet per day of gas and 21 barrels per day of condensate. The well has remained shut in since completion. When producing, it will mark the first production of oil or gas in Copiah County.

In 1971 there were three gas storage reservoirs in the State with a total capacity of 10,238 million cubic feet. These were Amory field in Monroe County, Jackson Dome in Rankin and Hinds Counties, and Eminence Dome in Covington County. During 1972, capacity was expanded to 108,956 million cubic feet, and gas in storage increased almost eight times from 9,318 million cubic feet at yearend 1971 to 71,964 million cubic feet on December 31, 1972. Two factors contributed to the increased gas storage capacity—the acquisition by Southern Natural Gas Co. of the Muldon field in the Black Warrior basin, Monroe County, for underground storage and an increase in the number of storage wells from 25 to 69.

Natural Gas Liquids.—Reserves of natural gas liquids decreased 313,000 barrels or 2.1%, according to the AGA. Mississippi contained 0.2% of the Nation's natural gas liquids reserves.

According to the Oil and Gas Journal annual survey of natural gas plants,[4] 10 plants in Mississippi at yearend 1972 had a total capacity of 306.7 million cubic feet per day, an increase of 49.6% over the 1972 capacity of 205 million cubic feet per day. This capacity was slightly more than 0.4% of the U.S. total. The survey indicated that the Mississippi plants operated at an average of 30% of capacity in 1972. The Laurel Gas Processing Plant of Clarco Pipe Line Co. in Jones County closed April 1. The new Shell Oil Co. Thomasville Plant in Rankin County began operations in late July to process the hydrogen sulfide gas produced in the Thomasville field.

Four companies conducted underground natural gas liquids storage operations in the Petal salt dome, Forrest County. According to the Natural Gas Processors Association (NGPA), 1973 LPG storage survey, storage capacity in the dome was 6.75 million barrels of propane and 177,000 barrels of butane-propane mix.

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[4] Oil and Gas Journal. 1973 Survey of Gas Processing Plants. V. 71, No. 28, 1973, p. 98.

Table 7.—Mississippi: Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Proved reserves Dec. 31, 1971	Changes in proved reserves due to extensions and discoveries in 1972	Proved reserves Dec. 31, 1972 (production deducted)	Changes from 1971 (percent)
Crude oil ... thousand barrels	342,368	30,682	312,458	−8.7
Natural gas liquids ... do	14,933	1,362	14,620	−2.1
Natural gas ... million cubic feet	1,117,432	96,606	1,104,336	−1.2

Source: American Petroleum Institute and American Gas Association.

Petroleum.—Mississippi ranked ninth in crude petroleum production and accounted for approximately 1.8% of U.S. output in 1972. State production of 61.1 million barrels of crude petroleum was valued at $192.5 million, an average unit value of $3.15 per barrel, the same as last year. Nine counties produced more than 2 million barrels of crude petroleum, and they accounted for 86.1% of the total State production. These counties, in descending order of production, were Clarke, Jasper, Lamar, Adams, Wayne, Yazoo, Jones, Franklin, and Smith. Salt water produced in association with crude petroleum production was 203.4 million barrels, an average of 3.3 barrels of water for each barrel of petroleum.

The 417 wells drilled for oil and gas in Mississippi represented 1.5% of the total wells drilled in the United States. According to American Petroleum Institute (API) drilling statistics, proved field well drilling activities decreased 36.7%, but exploratory drilling increased 18% over 1971 activities. There were 87 successes—78 oil and nine gas producers—from 181 proved field wells drilled. There were nine successful oil and four successful gas ventures from a total of 236 exploratory wells drilled, a success ratio of 5.5%. Exploratory drilling accounted for 56.6% of all drilling activity in the State.

Mississippi State Oil and Gas Board monthly bulletin data indicated that 42% of the exploratory wells were drilled to the Wilcox Formation (Tertiary age), 24% to Cretaceous age formations, and 21% to formations of Jurassic age. Of the proved field well completions, 35% were drilled to both the Wilcox Formation and formations of Cretaceous age, and 23% were drilled to Jurassic age formations, principally the Smackover. Exploratory oil and gas drilling totaled 2,187,519 feet to average almost 9,270 feet per well. The national average was approximately 5,970 feet per well. As of December 31, 1972, approximately 3,195 oil wells were producing an average of 53 barrels per well per day in Mississippi.

Proved crude oil reserves as of December 31, 1972, were 312.5 million barrels, 3.0 million barrels less than at yearend 1971, according to API estimates. Crude oil reserves-to-production ratio was 5.1:1, compared with the nationwide average of 10.5:1.

Crude-oil-refining capacity as of January 1, 1972, was 324,200 barrels per calendar day, an increase from 308,500 barrels per day on the same date in 1971.

Petrochemicals.—Shell Oil Co.'s Thomasville recovered-sulfur plant in Rankin County began operating in late July. Designed to treat 100 million cubic feet per day of sour gas, the installation can turn out more than 50 million cubic feet per day of sweet gas, (mostly methane) and recover about 1,250 long tons of sulfur per day.

Table 8.—Mississippi: Crude oil production, indicated demand, and stocks in 1972, by month

(Thousand 42-gallon barrels)

Month	Production	Indicated demand[1]	End of month stocks originating in Mississippi
January	5,017	5,166	3,979
February	4,760	4,592	4,147
March	5,195	4,587	4,755
April	5,166	5,362	4,559
May	5,306	5,186	4,679
June	5,108	5,505	4,282
July	5,251	5,170	4,363
August	5,233	5,418	4,178
September	4,964	5,399	3,743
October	5,083	5,224	3,602
November	4,895	4,683	3,814
December	5,122	5,113	3,823
Total:			
1972	61,100	61,405	XX
1971	64,066	64,609	XX

XX Not applicable.

[1] Calculated from monthly production and changes in stocks.

Table 9.—Mississippi: Crude petroleum production, by field

(Thousand 42-gallon barrels)

Field	1971	1972	Cumulative to Dec. 31, 1972
Baxterville	8,783	8,870	151,738
Bay Springs	2,375	2,110	22,843
Brookhaven	1,090	1,094	66,950
Bryan	1,362	1,027	21,451
Davis	1,141	1,517	3,632
East Eucutta	1,042	1,130	36,558
Gillsburg	1,131	961	3,358
East Heidelberg	2,760	3,678	70,248
West Heidelberg	1,175	1,450	33,585
East Nancy	1,252	971	5,547
West Nancy	1,994	1,729	4,887
Pachuta Creek	3,941	3,123	16,006
Quitman Field	1,925	1,232	12,284
Quitman Bayou	1,434	1,396	11,443
Raleigh	1,035	778	19,479
Soso	1,123	1,092	51,205
Tinsley	2,566	3,114	190,360
Other fields	27,937	25,828	671,391
Total	64,066	61,100	1,392,955

Source: Mississippi State Oil and Gas Board.

Ethyl Corp. of Richmond, Va., began manufacturing polyvinyl chloride plastic pipe and fittings in its $4 million new facility at Columbia. Mississippi Chemical Corp., and Coastal Chemical Corp., as part of a $3 million expansion, planned to expand the urea unit at Yazoo City from 280 to 530 tons per day.

NONMETALS

The combined value of nonmetals and natural gas liquids production was $40.1 million and represented 15.4% of the value of mineral production. This value of nonmetals including natural gas liquids production was a 13% increase over the comparable 1971 value.

Cement.—Portland and masonry cements were produced at two plants using the wet process. Raw materials used in making portland cement included limestone and cement rock, gypsum, marl, and oyster shells. Shipments of portland cement in 1972 were 20.4% greater than in 1971, and shipments of masonry cement increased 10.3% for the same period. Portland cement average unit value increased from $18.92 per ton in 1971 to $21.45 per ton in 1972, a 13.4% increase. Average unit value for masonry cement declined 2.2% from $21.18 per ton to $20.72 in 1972.

Portland and masonry cement consumed in the State totaled 928,979 tons and 71,712 tons, respectively. Most of the cement was shipped to ready-mix concrete companies. The second largest cement-consuming group was highway contractors.

United Cement, a subsidiary of Texas Industries Incorporated, announced plans to build a $15 million cement plant near Columbus. Initial capacity will be 376,000 tons annually, with provisions to expand the annual capacity to 1.1 million tons. The scheduled completion date was January 1974.

Clays.—Total clays sold and used decreased 15.8% from the record 2.28 million tons in 1971 to 1.92 million tons in 1972. However, average unit value increased from $3.73 per ton to $4.08 per ton during the same period; therfore, this commodity contributed 3% of the State's mineral production value. There was a small increase in the output of ball clay and fuller's earth. Common clay output decreased 19.5% but accounted for 78% of total clay output.

Clays were mined from 32 pits in 21 counties. Leading counties, in descending order of production, were Hinds, Marshall, Noxubee, and Monroe. Production from these four counties represented 68.1% of the State total. Common clay used for brick, lightweight aggregates, and sewer pipe was mined in 15 counties. Bentonite was mined in four counties. Fuller's earth was produced in Tippah County, and ball clay, in Panola County.

In May, Tri-State Brick & Tile Co., Inc. of Jackson began constructing a $2.5 million addition that would increase production capacity from 150,000 bricks per day to 240,000 bricks per day. Completion of the addition was scheduled for Spring 1973.

Lime.—Corchem, Inc., produced quicklime at Pascagoula in Jackson County from stone quarried in Alabama. The lime was consumed in Mississippi in the production of magnesite. Output decreased almost 15% from that of 1971.

Magnesium Compounds.—Production of magnesium compounds used in the manufacture of refractory brick increased significantly in 1972, but the 1971 production was 28.5% lower than that of 1970. Ouput in 1972 was 26.7% higher than comparable

Table 10.—Mississippi: Clays sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Year	Bentonite		Ball clay, fire clay, and fuller's earth		Common clay		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1968	277	3,128	353	4,525	1,063	1,422	1,693	9,075
1969	299	3,525	305	3,999	1,099	1,136	1,703	8,660
1970	262	3,124	318	3,930	974	1,008	[1] 1,553	8,062
1971	281	3,396	[2] 137	[2] 2,966	1,860	2,139	2,278	8,501
1972	278	3,388	[2] 144	[2] 2,943	1,497	1,506	1,919	7,837

[1] Data do not add to total shown because of independent rounding.
[2] Ball clay and fuller's earth.

production in 1971. Unit value averaged a relatively insignificant increase of 5 cents per ton.

Perlite.—Johns Manville Perlite Corp. continued to produce expanded perlite in Adams County for roof insulation board. Production was 23.5% greater in 1972 than in 1971, in which year an 11% decrease in production occurred. Average unit value increased slightly more than 1%.

Sand and Gravel.—Production was reported from 35 companies operating in 22 counties. Output was 13.42 million tons, 18.9% greater than in 1971. The leading producing counties, in descending order of output, were Copiah, Lowndes, Forrest, Carroll, and De Soto. These five counties accounted for 53.4% of the total production and 55.6% of the value. The average unit value was $1.20 per ton, the same as last year.

Sand output totaled 4,862,000 tons. Construction accounted for 55.2% of the sand used and paving operations consumed 41.2%. Fill, railroad ballast, and miscellaneous uses accounted for the remaining 3.6% of sand use. Principal use for the 8,557,000 tons of gravel were paving, 62.8%; construction, 33.9%; fill, railroad ballast, and miscellaneous uses, the remaining 3.3%. The average unit value of gravel decreased 7.4% to $1.25 per ton.

Stone.—Crushed and broken limestone was produced in Clay, Rankin, and Warren Counties, and marl was produced in Rankin and Warren Counties. Total stone output from four quarries totaled 1,135,160 tons. This was an increase of 56.3% over the revised stone output of 726,000 tons in 1971. Average unit value for all stone increased 8.2% to $1.06 per ton. Principal uses of stone produced in Mississippi were for cement manufacture and for agricultural purposes.

Sulfur.—Recovery of sulfur from refinery and natural gases was reported from Clarke, Lamar, and Rankin Counties. Shell Oil Co.'s recovered sulfur plant in Rankin

Table 11.—Mississippi: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,595	2,848	2,627	2,989
Fill	W	W	78	72
Paving	1,719	1,746	2,008	2,137
Railroad ballast	W	W	W	19
Other uses [1]	149	223	98	138
Total	4,463	4,317	4,806	5,355
Gravel:				
Building	2,729	3,516	2,831	3,724
Fill	W	W	(2)	(2)
Paving	3,910	5,330	5,373	6,588
Railroad ballast	--	--	2	(2)
Miscellaneous	W	W	284	199
Other uses	131	249	--	--
Total [3]	6,770	9,095	8,489	10,512
Government-and-contractor operations:				
Sand:				
Building	--	--	56	86
Paving	25	37	--	--
Total [3]	25	37	56	86
Gravel:				
Building	--	--	68	180
Paving	31	77	--	--
Total [3]	31	77	68	180
Total sand and gravel [3]	11,289	13,526	13,419	16,133

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes molding and other sands.

[2] Included with miscellaneous gravel.

[3] Data may not add to totals shown because of independent rounding.

County began operation in late July. Treating sour natural gas, it has a design capacity of 1,250 long tons of elemental sulfur per day. This new plant was mainly responsible for the nearly 80% increase over that of 1971 in recovered sulfur. Average unit value decreased 18.8% from comparable 1971 figures.

Table 12.—Principal producers

Commodity and company	Address	Type of activity or producing fields	County
Cement:			
Marquett Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	Plant	Rankin.
Valley Cement Ind., Inc.	Box 22491 Jackson, Miss. 39205	do	Warren.
Clays:			
American Colloid Co.	5100 Suffield Ct. Skokie, Ill. 60076	Mine	Itawamba and Monroe.
Delta-Macon Brick & Tile Co. Inc.	R.F.D. 3, Box 2 Macon, Miss. 39341	Mine and plant	Noxubee.
Filtrol Corp	3250 East Washington Blvd. Los Angeles, Calif. 90023	do	Itawamba and Smith.
Holly Springs Brick & Tile Co., Inc.	Box 310 Holly Springs, Miss. 38635	do	Marshall.
International Minerals & Chemical Corp.	Administration Center Old Orchard Rd. Skokie, Ill. 60076	Mine	Monroe.
Tri-State Brick & Tile Co., Inc.	Box 9787 Jackson, Miss. 39206	Mine and plant	Hinds.
Lime: Corchem, Inc	Box 1707 Pascagoula, Miss. 39567	Plant	Jackson.
Magnesium compounds: Corchem, Inc., Pascagoula, Miss., plant.	Box 1486 Pascagoula, Miss. 39567	do	Do.
Sand and gravel:			
American Sand & Gravel Co.	Box 272 Hattiesburg, Miss. 39401	Stationary	Forrest.
Blaine Gravel Co.	Box 268 Crystal Spring, Miss. 39059	do	Copiah.
Contractors Gravel Co.	P.O. Box 2069 Columbus, Miss. 39701	Portable	Monroe.
J. J. Ferguson Sand & Gravel.	Box 318 Greenwood, Miss. 38930	Stationary	Carroll.
Green Bros. Gravel Co., Inc.	Route 4, Box 17 Franklinton, La. 70438	do	Copiah.
Hammett Gravel Co.	Box 207 Lexington, Miss. 39095	do	Pike.
Memphis Stone & Gravel Co.	Box 6246 Memphis, Tenn. 38111	do	De Soto.
Petermann Gravel Corp.	P.O. Box 161 Yazoo City, Miss. 39194	do	Yazoo.
W. J. Runyon & Son, Inc.	3812 Oak St. Vicksburg, Miss. 39180	do	Warren.
Traxler Gravel Co., div. of Delta Ind., Inc.	Box 1292 Jackson, Miss. 39205	Stationary and dredge	Copiah.
Stone:			
Marquette Cement Mfg. Co.	20 North Wacker Drive Chicago, Ill. 60606	Quarry	Rankin.
Valley Cement Ind., Inc.	Box 22491 Jackson, Miss. 39205	do	Warren.
State Department of Agriculture and Commerce.	West Point, Miss. 39773	do	Clay.
Oil and gas:			
Atlantic Richfield Co.	Box 2819 Dallas, Tex. 75221	East Heidelberg	Jasper.
Chevron Oil Co., Western Div.	Box 599 Denver, Colo. 80201	Brookhaven	Lincoln.
		South Center Ridge	Smith.
		Cranfield	Adams and Franklin.
		Hub	Marion.
		Hub East	Do.
		Knoxo	Walthall.
		East Mallalieu	Lincoln.
		West Mallalieu	Do.
		Mize	Smith.
		Pisgah	Rankin.
		Puckett	Rankin and Smith.
		Raleigh	Simpson.
		Reedy Creek	Jones.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity or producing fields	County
Oil and Gas—Continued			
Cities Service Oil Co	Box 12026 Jackson, Miss. 39211	Hazlit Creek	Wilkinson.
		North Mud Creek	Do.
Continental Oil Co	Box 2197 Houston, Tex. 77001	Davis	Clarke.
Getty Oil Co	Box 1404 Houston, Tex. 77001	East Nancy	Do.
		West Nancy	Do.
Gulf Oil Corp	Box 1166 Pittsburgh, Pa. 15230	Baxterville	Lamar and Marion.
		Bolton	Hinds.
		Gwinville	Jefferson Davis.
		Heidelberg	Jasper.
		East Heidelberg	Do.
		West Heidelberg	Do.
		Pistol Ridge	Forrest and Pearl River.
		Soso	Jasper, Jones, Smith.
		East Yellow Creek	Wayne.
Humble Oil & Refining Co	Box 2180 Houston, Tex. 77001	Baxterville	Marion and Lamar.
		Bryan	Jones and Jasper.
		East Fairview	Adams.
		Gillsburg	Amite.
		Gwinville	Jefferson Davis.
		Hub	Marion.
		Hub East	Do.
		Knoxo	Walthall.
		Pistol Ridge	Pearl River.
		Sandy Hook	Marion.
		East Yellow Creek	Wayne.
Meason Operating Co	Natchez, Miss. 39120	North Carthage Point	Adams.
		Clear Springs	Franklin.
		Courtland	Adams.
		Dexter	Walthall.
Amoco Production Co	Box 591 Tulsa, Okla. 74102	Clear Springs	Franklin.
		Collins	Covington.
		Dollar Lake	Leflore.
		Dry Bayou	Franklin.
		North Freewoods	Do.
		Knoxville	Do.
		North Knoxville	Do.
		Quitman Bayou	Adams.
		Stringer	Jasper.
		Zeigler Creek	Franklin.
Pennzoil Producing Co	900 Southwest Tower Houston, Tex. 77002	Tinsley	Yazoo.
Placid Oil Co	1401 Elm. St. Dallas, Tex. 75202	Nancy	Clarke.
Shell Oil Co	Shell Building 921 Common New Orleans, La. 70112	Pachuta Creek	Do.
		Goodwater	Do.
		Bay Springs	Jasper.
		Tallahala Creek	Smith.
		East Tallahala Creek	Do.
Skelly Oil Co	Box 1650 Tulsa, Okla. 74101	Bay Springs	Jasper.
		Goodwater	Clarke.
Sun Oil Co	1608 Walnut Philadelphia, Pa. 19103	Baxterville	Lamar.
		Diamond	Wayne.
		West Eucutta	Do.
		East Franklin	Franklin.
		East Heidelberg	Jasper.
		Kokomo	Walthall.
		Mantua	Adams.
		McComb	Pike.
		Mercer	Adams.
		Pistol Ridge	Forrest and Pearl River.
		Sandy Hook	Marion.
		Smithdale	Amite.
		Tom Branch	Franklin.
		West Yellow Creek	Wayne.
Texaco, Inc	Box 60252 New Orleans, La. 70150	Baxterville	Lamar.
		Pachuta Creek	Clarke.
Petroleum refineries:			
Amerada Hess Corp., Hess Oil & Chemical Div.	One Hess Plaza Woodbridge, N.J. 07095	Purvis refinery	Calhoun.
Southland Oil Co	P.O. Box 328 Yazoo City, Miss. 39194	Sandersville refinery	Jones.
		Lumberton refinery	Lamar.
		Crupp refinery	Yazoo.
Standard Oil Co	P.O. Box 328 Yazoo City, Miss. 39194	Pascagoula refinery	Jackson.

The Mineral Industry of Missouri

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Missouri Geological Survey for collecting information on all minerals.

By J. Patrick Ryan [1] and James A. Martin [2]

With a 13% rise over 1971, the value of Missouri's mineral output reached nearly $452 million in 1972, an alltime high for the ninth consecutive year. This spectacular record was highlighted by a large increase in output of lead and significant increases in zinc and copper.

Principal minerals produced, in order of value, were lead, cement, stone, iron ore, lime, coal, and zinc.

Trends and Developments.—Missouri ranked 17th among the States in mineral output in 1972, up from 21st in 1968. The rising trend in recent years in the value of Missouri's mineral output resulted from the alltime record production of individual commodities. In the past decade the State's total mineral output tripled in value. Figure 1 graphically shows this striking and well-defined trend. New mineral discoveries and new plant construction in recent years have resulted in wide diversification and broadly-based expansion of Missouri's mineral industry. Exploration, research, and development give promise of sustaining and extending this growth pattern.

Significant events during 1972 relating to and affecting the mineral industry in Missouri included the shutdown of the last mine in the Old Lead Belt of southeast Missouri and development of the new Brushy Creek mine on the Viburnum Trend. Mining activity in the Old Lead Belt came to a complete halt—"the end of an era"—with the closing of the Federal Division mine of St. Joe Minerals Corp. on October 1. The closure brought to an end one of the world's great mining districts. But, as a great mining district was dying, a new mining district—the Viburnum Trend—was being born, and may be even greater than its predecessor. St. Joe Minerals Corp. had mined in the Old Lead Belt for more than 100 years and extracted more than a quarter billion tons of ore containing 10 million tons of lead metal and 2 million tons of zinc.

Development by St. Joe of the Brushy Creek mine was timed to compensate for the shutdown of the Old Lead Belt and was the last of the mines planned to develop the extensive lead resources in the Ozarks called the Viburnum Trend. At yearend the production shaft was completed to 1,390 feet, the man shaft was nearing completion, development work was in progress, and the 5,000 tons-per-day concentrator was nearly ready for operation.

Brushy Creek will produce about 50,000 tons of lead annually compared to 38,000 tons from the Federal mine in its last full year of production, and it will add 1,200 tons of copper concentrate and 7,200 tons of zinc concentrate. Other efficiencies associated with this new mine will, according to company estimates, result in savings of about 4 cents per pound of lead at full production. Target date for startup of Brushy Creek was May 1973.

A number of problems plagued the Missouri mineral industry. Copper concentrates were beginning to accumulate in stockpiles at mines in the Viburnum Trend with no smelter contracts in sight; other contracts with smelters for copper concentrate were facing termination. One producer had more than a year's production of copper concentrate stockpiled—with no place to process it. Zinc concentrates

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Table 1.—Mineral production in Missouri [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Barite……thousand short tons	232	$8,606	218	$8,637
Cement:				
Portland……do	4,515	77,568	4,277	80,898
Masonry……do	78	1,629	80	1,859
Clays [2]……do	2,354	7,454	2,571	9,096
Coal (bituminous)……do	4,036	19,670	4,551	23,667
Copper (recoverable content of ores, etc.)……short tons	8,445	8,788	11,509	11,785
Iron ore (usable)……thousand long tons, gross weight	2,727	W	2,695	W
Lead (recoverable content of ores, etc.)……short tons	429,634	118,579	489,397	147,113
Natural gas……million cubic feet	22	5	9	2
Petroleum (crude)……thousand 42-gallon barrels	66	W	60	W
Sand and gravel……thousand short tons	10,327	15,109	10,082	14,806
Silver (recoverable content of ores, etc.)……thousand troy ounces	1,661	2,568	1,972	3,322
Stone……thousand short tons	41,099	[3] 64,772	42,478	[3] 63,219
Zinc (recoverable content of ores, etc.)……short tons	48,215	15,525	61,923	21,983
Value of items that cannot be disclosed:				
Asphalt (native), clays (bentonite and kaolin), lime, stone (dimension), and values indicated by the symbol W	XX	64,821	XX	70,480
Total	XX	400,089	XX	451,817
Total 1967 constant dollars	XX	340,196	XX	p 375,867

p Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes certain clays; included with "Value of items that cannot be disclosed."

[3] Excludes value of certain stone; included with "Value of items that cannot be disclosed."

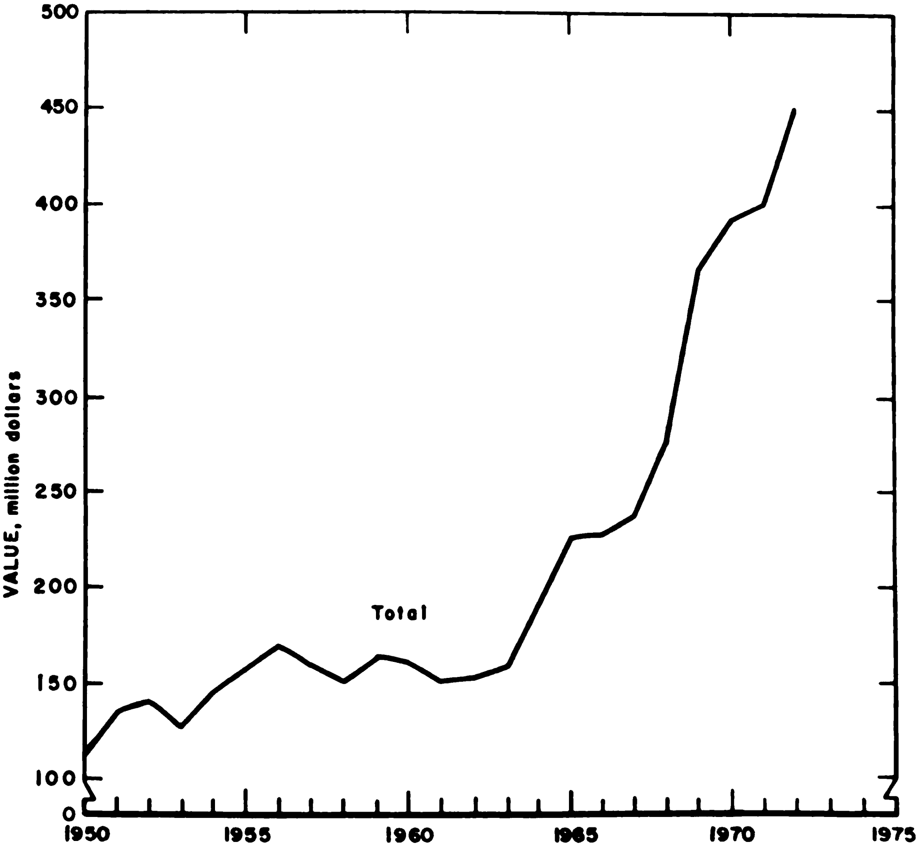

Figure 1.—Total value of mineral production in Missouri.

Table 2.—Value of mineral production in Missouri, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adair	W	W	Stone.
Atchison	W	W	Petroleum.
Audrain	$1,761	$1,635	Clays.
Barry	W	W	Stone.
Barton	W	W	Coal, stone, native asphalt.
Bates	149	W	Coal, stone.
Benton	W	W	Stone.
Boone	5,068	4,150	Coal, stone, sand and gravel, clays.
Buchanan	W	W	Stone.
Butler	269	W	Sand and gravel, clays.
Caldwell	W	W	Stone, natural gas.
Callaway	1,624	2,071	Clays, stone, coal, sand and gravel.
Camden	W	--	
Cape Girardeau	W	W	Cement, stone, sand and gravel, clays.
Cass	W	W	Stone, petroleum.
Cedar	94	W	Stone.
Chariton	W	W	Stone, sand and gravel.
Christian	W	W	Stone.
Clark	W	W	Stone, sand and gravel.
Clay	W	W	Do.
Clinton	W	396	Stone.
Cole	391	W	Stone, sand and gravel.
Cooper	W	W	Do.
Crawford	3,990	W	Lead, copper, zinc, sand and gravel, silver.
Dade	W	W	Stone.
Dallas	W	W	Do.
Daviess	W	W	Stone, sand and gravel.
De Kalb	125	182	Stone.
Douglas	W	W	Sand and gravel.
Dunklin	W	--	
Franklin	W	W	Stone, clays, sand and gravel.
Gasconade	1,765	W	Clays, sand and gravel.
Gentry	W	W	Stone, sand and gravel.
Greene	W	W	Stone, lime.
Grundy	W	W	Stone, sand and gravel.
Harrison	W	W	Do.
Henry	W	W	Coal, stone.
Hickory	W	W	Stone.
Holt	W	W	Stone, sand and gravel.
Howard	W	W	Stone.
Howell	W	W	Stone, sand and gravel.
Iron	84,729	110,512	Lead, zinc, iron ore, copper, silver, stone.
Jackson	12,632	15,735	Cement, stone, sand and gravel, clays, petroleum.
Jasper	W	W	Stone, sand and gravel.
Jefferson	W	W	Cement, stone, sand and gravel, clays.
Johnson	W	304	Stone.
Knox	W	W	Do.
Laclede	W	W	Stone, sand and gravel.
Lafayette	W	W	Do.
Lawrence	W	W	Stone.
Lewis	W	W	Sand and gravel, stone.
Lincoln	W	W	Stone, sand and gravel, clays.
Linn	W	--	
Livingston	1,237	993	Stone, clays, sand and gravel.
Macon	W	W	Coal.
Madison	20	--	
Marion	W	W	Stone, lime.
Mercer	W	239	Stone.
Miller	W	W	Sand and gravel.
Moniteau	W	102	Stone.
Monroe	271	270	Clays, stone, sand and gravel.
Montgomery	765	1,129	Do.
Newton	137	446	Stone.
Nodaway	W	W	Stone, sand and gravel.
Oregon	15	9	Stone.
Osage	W	W	Clays.
Ozark	--	14	Stone.
Pemiscot	350	W	Sand and gravel.
Perry	W	W	Stone.
Pettis	W	W	Do.
Phelps	151	W	Clays, stone.
Pike	W	W	Stone, clays.
Platte	1,210	W	Clays, stone.
Polk	W	W	Stone.
Pulaski	176	W	Sand and gravel, stone.
Putman	W	W	Coal.
Ralls	W	W	Cement, stone, clays.
Randolph	W	W	Coal, stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Missouri, by county[1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Ray	$1,710	$1,788	Stone.
Reynolds	45,421	55,644	Lead, zinc, copper, silver, sand and gravel, stone.
St. Charles	2,368	2,301	Stone, sand and gravel, clays.
St. Francois	12,734	12,162	Lead, lime, stone, copper, silver.
St. Louis	29,663	28,855	Cement, stone, sand and gravel, clays, petroleum.
Ste. Genevieve	33,211	28,410	Stone, lime, sand and gravel.
Saline	476	W	Stone.
Scotland	W	W	Do.
Scott	W	W	Stone, clays.
Shannon	W	W	Stone.
Shelby	W	W	Do.
Stoddard	434	W	Sand and gravel.
Stone	--	W	Stone.
Sullivan	W	W	Do.
Taney	--	W	Stone, sand and gravel.
Vernon	235	286	Stone, native asphalt, coal, petroleum, sand and gravel.
Warren	252	W	Clays, stone.
Washington	45,177	49,651	Iron ore, lead, barite, copper, zinc, silver, sand and gravel.
Wayne	135	243	Stone.
Wright	W	W	Do.
Undistributed[2]	111,343	134,355	
Total[3]	400,089	451,817	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties were not listed because no production was reported: Andrew, Bollinger, Carroll, Carter, Dent, McDonald, Maries, Mississippi, Morgan, New Madrid, Ripley, St. Clair, Schuyler, Texas, Webster, and Worth.

[2] Includes value of sand and gravel and stone not assigned to specific counties, value of petroleum for which county data was unavailable for 1971, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Missouri business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force ... thousands	2,092.9	2,096.4	+0.2
Unemployment ... do	111.5	105.0	−5.8
Employment ... do	1,981.4	1,991.4	+.5
Construction ... do	71.8	67.9	−4.8
Mining ... do	8.8	8.2	−6.8
Manufacturing ... do	427.1	434.1	+1.6
Personal income:			
Total ... millions	$18,587	$19,991	+7.6
Per capita	$3,940	$4,206	+6.8
Construction activity:			
Building permits, total private nonresidential ... millions	$293.4	$345.9	+17.9
Cement shipments to and within Missouri ... thousand short tons	2,062	1,839	−10.8
Mineral production value ... millions	$400.1	$451.8	+12.9

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

were also piling up with no smelters to take them. A statement by one of the major producers that the situation is " . . . becoming critical and the outlook is most uncertain . . ." well described the zinc and copper situation in Missouri at yearend. Amax Lead & Zinc, Inc., announced its intention to spend about $20 million to buy and renovate the electrolytic zinc plant at Sauget, Ill., formerly operated by American Zinc Co. The Sauget plant was scheduled to reopen in 1973 and may provide an outlet for some Missouri zinc concentrate.

Fuel shortages were beginning to hamper the mining and metallurgical industry of the State. Natural gas was cut off from smelters and iron pellet plants in the fall of 1972 and liquid gas facilities had to be installed. The prospects for resumption of natural gas deliveries were bleak. Indications at yearend were that the fuels situation as a whole might get worse before it gets better.

The mineral industry was endeavoring to meet ever more stringent environmental standards. New air, water, and reclamation laws and regulations were enacted. New health and safety regulations and intensified inspections by State and Federal agencies also became effective in 1972.

The Mining Industry Council of Missouri, incorporated in December 1971 as an association of Missouri mining companies to promote the interests and help solve some of the problems of the mining industry in Missouri, began to hold regular meetings, to formulate plans, and set up action programs. One of the Council's first activities was to survey the industry for details on the economic and social impact of mining on the State of Missouri.

State Geologists from Kansas, Nebraska, Iowa, and Missouri met formally to discuss mutual problems and possible solutions. This was another in a series of efforts by these States to examine the many mineral resources and mineral industry related problems on a regional basis rather than on a State basis.

Much of the mining activity in the Viburnum Trend is within the boundaries of Clark National Forest. Revenues paid to the Forest Service during fiscal year 1972 grew to $2,179,622. Of this, $2,033,965 was royalties and fees from mining companies. By law, 25% of the Forest receipts were returned to the counties within which these lands are located. These funds must be spent by the counties for schools and roads. Eighteen Missouri counties shared $544,905.

Labor and Employment.—According to the Division of Employment Security, Missouri Department of Labor and Industrial Relations, the mining industry employed 8,237 workers in 1972, a decline from the 8,757 in 1971. Employment in the coal industry increased to 1,051 from the 997 in the previous year. Employment in the metal mining industry decreased to 3,363 from 3,682 in the previous year, and the nonmetals industry employed 3,643 in 1972 compared with 3,896 in 1971. The declining overall employment coupled with increased output for most commodities, indicates an increase in efficiency and productivity. As a further example, St. Joe Minerals Corp. reported that, in the last 10 years, employment at its Southeast Missouri Division had been reduced from 1,930 to 1,175 persons, although production increased by 122% during the same period.

St. Joe Minerals Corp. and United Steelworkers of America signed a new 3-year contract in April without a work stoppage at its mines and mills. A new 3-year contract was also signed at the Herculaneum smelter after a 2-week strike.

Noranda Aluminum, Inc., plagued by labor troubles during construction of its new plant at New Madrid, filed in U.S. District Court in St. Louis, a $1 million damage suit against Carpenters Union Local 618 of Sikeston, Mo. A spokesman for Noranda said that, as a result of the strike in 1970, the facility lost about 15,411 man-days of production.

Legislation and Government Programs.—In 1966, the 73d General Assembly of Missouri passed Senate Bill 13 establishing an Oil and Gas Council along with supporting legislation based on model conservation statutes suggested by the Interstate Oil Compact Commission. In the intervening years, several bills were introduced that would have eliminated most, if not all, of the Council's regulatory authority over drilling, casing and operating of wells, furnishing of bonds, and all other normal conservation practices. All of the bills were defeated. However, in 1972, House Bill 1176 was introduced and passed the House by a vote of 101 to 39. This bill was revised by a Senate Committee to retain the essential features of the original SB 13 and subsequently passed by both Houses and signed into law. The revisions provided by this new law included the addition of two members to the Council, elimination of the $25 drilling permit fee, replacement of a section of the old law dealing with unitization, with a new section allowing the Council to "authorize unitization for certain recovery methods . . ." based upon a 75% approval of the royalty owners, and a redefinition of waste to exclude "unavoidable or accidental waste." The expanded Council began revising its rules and regulations to conform to the new legislation and began considering modification of plugging methods, well lo-

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	460	294	135	1,023	1	31	31.27	NA
Metal	2,949	276	815	6,521	6	260	40.79	6,448
Nonmetal	709	242	172	1,382	1	43	31.84	5,256
Sand and gravel	523	239	125	1,080	1	22	21.30	6,420
Stone	4,183	271	1,134	9,278	4	219	24.04	3,455
Total	8,824	270	[1] 2,380	19,284	13	575	30.49	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	2,815	274	772	6,179	3	243	39.81	4,442
Nonmetal	700	236	166	1,338	1	42	32.14	4,939
Sand and gravel	355	214	76	639	1	17	28.16	14,458
Stone	3,370	281	947	7,787	3	196	25.55	2,980
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data do not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

cation survey requirements, and the amount of bond required.

A St. Louis city law limiting exhaust emissions from motor vehicles was upheld by the Missouri Court of Appeals. In a test case, it was argued that the law was too vague in specifying what degree of exhaust pollution violated the law. The court ruled that the city had proved pollution as defined by the Ringelman Chart.

A new Missouri Air Conservation Law was passed by the 76th General Assembly and signed by the Governor. The law increases the maximum penalty for violations of State air pollution regulations to $5,000 per day. Previously the penalty could not exceed $200 per day. In addition, the law allows the Air Quality Commission to take action against companies outside the boundaries of Missouri that pollute Missouri air. The new law also allows certificates of authority (previously called "exemptions") to be granted to third and fourth class counties that join in an air pollution control program with a first class county. Other provisions of the law require the State to set up an air pollution permit system, make it permissible for one Commission member to conduct an appeals hearing or meeting to consider variances, give more complete emergency procedures, and change the makeup of the Commission by no longer requiring that there be municipal government or ex officio members.

The Missouri Legislature voted a 2-cent increase in the State's gasoline tax from 5 cents a gallon to 7 cents a gallon. In 1971 the Governor vetoed a gas tax hike because it was not linked with a highway construction bond issue. He signed the measure this year shortly after a drive had started to place a $730 million highway bond issue on the ballot. That drive failed.

One of the two new mined land reclamation laws passed by the Missouri General Assembly in 1971 became effective in January 1972 (for coal and barite), and the other became effective in March (for other minerals).

An Energy Emergency Task Force was created by executive order of the Governor to take action on Missouri's fuel and energy situation. Critical shortages at such essential establishments as hospitals and schools made necessary a State agency that could act quickly in an emergency. The task force was directed to assess fuel distribution needs within the State, develop measures for conservation of fuel, identify fuel problems as they arise, and help alleviate any fuel shortages that might occur during the winter of 1972-73.

The Governor signed a bill setting up a new Clean Water Commission to replace the former Water Pollution Board and appointed six members to the new commission. The new law is designed to give the commission stronger powers and provides that only two members shall represent agriculture, mining, or industrial interests. In addition to reorganizing the commission, the new law includes a broader definition of what can be considered pollution and carries larger fines.

Environment.—Pollution, environmental and ecological matters have greatly influenced the course of the Missouri mineral industry in recent years. In 1972, new Federal and State laws and regulations became effective and compliance was a major concern of the mineral industry.

The seven-member Mined Land Reclamation Commission began to administer and enforce Missouri's reclamation laws. Applications were being processed, bonds collected, and field inspection of reclamation problems and practices was underway. Under the new laws, a yearly permit is required in order to operate a surface mine. A basic fee of $50 and an acreage fee of $17.50 per acre are required, and a bond must be posted to insure that the area mined will be reclaimed. During the period March 28 (when the law became effective) through December 31, 1972, the Commission issued 10 permits for coal strip mines that would affect some 1,100 acres, and 14 permits for barite operations covering about 130 acres. The Commission issued 204 additional permits covering the surface mining of limestone, clay and shale, and sand and gravel. The limestone quarries affected about 750 acres, sand and gravel about 230 acres, and clay pits about 180 acres. The director of the Commission reported that inclement weather seriously affected reclamation during much of the 1972 season. Company reports and field checks indicated that approximately 80% of the required grading was completed on 1972 mined acreages. Permit and acreage fees collected for surface mining in 1972 amounted to $54,530. Permit applications for 1973 received in 1972 indicated that surface mining in Missouri was expanding, particularly in the coal sector. The many problems incident to administering the State's new reclamation laws were summarized by the State Geologist.[3]

The U.S. Secretary of Agriculture announced that a new "land purchase unit" had been chosen in central Missouri. The acquisition plan of the Forest Service provides that such land can be purchased when funds become available. Pollution abatement is one of the high priority considerations in such new purchase units and the area in central Missouri was chosen in part because it contains about 2,000 acres of unreclaimed strip-mined land that has been a source of acid drainage.

The City of St. Louis, Union Electric Co. (UE), and the Environmental Protection Agency (EPA) were evaluating the experimental "trash-to-kilowatts" project in which about 30% of the 1,000 tons of refuse collected daily in St. Louis is shredded and fed to boilers at the Meramec power plant at a rate of 10% trash to 90% coal. Favorable progress was reported, but several problems remained, including a method for getting nonferrous metals and glass out of the rubbish.

N L Industries Inc. completed a $5 million emissions control program at its titanium pigment plant near St. Louis. The bulk of the company's program was for a $4 million sulfuric acid plant, and the balance was for changes in production processes, installation of wet scrubbers, dust collectors, and electrostatic precipitators. Tests were being conducted to determine whether the plant had reached compliance with St. Louis County air quality standards.

St. Joe Minerals Corp. reported that it had budgeted $8.7 million in capital expenditures for environmental improvement during 1972 out of a total budgeted capital expenditure of $24 million. The major program was to continue the reduction of sulfur discharge into the air at its smelters.

After nearly 4 years of "tinkering" and spending more than $3 million, UE decided to abandon—at least temporarily—a "pioneering air pollution control system" at its Meramec power plant in south St. Louis County. The decisive factor was the clogging of the boiler with deposits of calcium and sulfur compounds. When it was installed in 1968, the system, called a limestone injection scrubbing process, drew international attention as the first of its kind on a full-scale powerplant. It was intended to remove sulfur oxides from the exhaust stream of the coal-fired boiler, but, according to the company spokesman, it had been plagued with problems from the beginning and operated only intermittently. With the system out of operation, exhaust gases were routed to a conventional gas-cleaning system, an electrostatic precipitator that removes only the fly ash.

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[3] Howe, W. B. Land Reclamation Law in Missouri—An Appraisal at Six Months. Missouri Mineral News (Mo. Geol. Sur.), v. 12, No. 4, April 1972, pp. 56–62.

The St. Louis County Air Pollution Board gave UE an extension of its variance to meet antipollution requirements at the Meramec power plant. The company sought the extension because of construction delays at the new Labadie plant and because its natural gas supply had been reduced. The extension was also given to allow "time to develop sulfur dioxide removal technology." UE was also granted an extension for its Portage des Sioux power plant. The variance stipulated that UE must continue its efforts to cut pollution and install sulfur removal devices as soon as technically feasible. The director of the Missouri Air Quality Commission said that "technology is not available for sulfur removal and we don't feel we can require them to do something they can't live up to."

Seven parts of Missouri's proposed clean-air plan were rejected as inadequate by the Federal Government. EPA approved proposals for controlling sulfur oxides, particulate matter, and carbon monoxide, but the plan for nitrogen oxide was rejected. Also rejected were provisions on legal authority to enforce the plan, information disclosure to the public, air-pollution emergencies, monitoring of air quality and pollution sources, and check of new pollution sources. The State was endeavoring to find ways of complying.

The Interdisciplinary Lead Belt Team of the Environmental Research Center at the University of Missouri—Rolla, submitted its interim progress report "An Interdisciplinary Investigation of Environmental Pollution in the New Lead Belt of Southeast Missouri" to the National Science Foundation. The specific research aims of this first year of the project were summarized and included a definition of the study area, selection of sampling sites, identification of all processes involved in transporting lead and other metals from source to consumer, and an evaluation of the impact that lead and other heavy metals were making on the ecosystem. The National Science Foundation approved and funded an extension of this project into 1974.

Health and Safety.—The Bureau of Mines subdistrict office, Metal and Nonmetal Mine Inspection, reported eight fatalities in metal and nonmetal mines of Missouri during 1972. Two of these were in underground lead-zinc mines, one in an underground iron mine, three in stone operations, one in a barite mine, and one in a sand pit. One fatality was reported for Missouri coal mines.

Ozark Lead Co. won top honors in the Underground Metal Mine category in the 1971 National Safety Competition sponsored jointly by the American Mining Congress and the U.S. Bureau of Mines. For 394,698 man-hours worked without a disabling injury, the company was awarded the Sentinels of Safety trophy and flag. The Director of the U.S. Bureau of Mines made the award presentation at the mine in southeast Missouri.

The Missouri State Mine Inspector issued the 84th (1971) Annual Report of the Division of Mine Inspection, State of Missouri, with an assemblage of information and statistics on the mineral industry of Missouri not readily available elsewhere.

Exploration, Geologic Studies, and Mapping.—Although the intensive drilling activities that led to discovery and delineation of the Viburnum Trend in the 1960's had slackened, exploration was being carried on in several areas and geologic studies and mapping programs were being carried out by State, Federal, and private organizations.

Getty Oil Co. and Azcon Corp. (formerly American Zinc Co.) continued to drill a copper-iron prospect near Boss. Drilling has been going on for several years in that area but a decision on the future of this project has been deferred. It was reported that many drill holes looked promising, but an evaluation could not yet be made of the feasibility of mining the deposit and its commercial potential. It was proposed that if further drilling was encouraging, a pilot shaft costing about $3 million might be sunk.

Exploratory drilling of the large iron ore deposit at Bourbon was completed by Azcon Corp. and Granite City Steel Co. However, a decision about mining this deposit was to be delayed until technological and economic studies were completed. Exploration was reported to have shown the existence of 177 million long tons of ore having a grade of 29% iron in the form of magnetite.

A description of the mode of occurrence of the lead-zinc-copper-silver deposits in the Viburnum Trend was published.[4]

The Missouri Geological Survey continued its "Operation Basement" project which was designed to provide as much information as possible on the State's Precambrian "basement" because of its importance as a possible mineral source. Three reports in this series were published in recent years; another report in the series was published during 1972. This report dealt with the petrochemical relationships in the St. Francois Mountains. It provides information on magnetic processes during a major petrogenic epoch in the Precambrian of the Midcontinent, defines the chemical character and relationship of different rock types, classifies the different rocks of the ore-bearing petrographic province and compares this province with other world occurrences.[5]

The Bibliography of the Geology of Missouri, 1971, was made available by the Missouri Geological Survey. This booklet lists published and unpublished papers, indexed by subject, county, and author, about Missouri's geology that were issued during 1971. Papers appearing before 1971 that were not cited in previous bibliographies are also included.

Table 5.—Exploratory drilling in Missouri

(Linear feet)

Year	Churn	Rotary	Diamond
1968	45,272	48,011	211,498
1969	73,874	21,442	167,179
1970	38,080	28,556	248,009
1971	26,548	29,188	228,110
1972	28,025	19,957	194,278

The Missouri Geological Survey continued field work on a complete revision of the Geologic Map of Missouri with completion scheduled for the mid-1970's.

At the beginning of 1972, only 60.6% of the topographic maps covering the State of Missouri were the modern 7-½-minute versions. Even though 99.5% of the State has been mapped, 38.9% of the maps are at the smaller 15-minute scale. Topographic map sales by the Missouri Geological Survey have escalated from 13,438 in 1962 to 35,355 in 1971.

The Missouri Survey issued a revised List of Publications updated to the end of 1972. This list is available from Missouri Geological Survey, Box 250, Rolla, Mo. 65401.

REVIEW BY MINERAL COMMODITIES

NONMETALS

In 1972, nonmetals accounted for about 45% of the State total mineral output value compared with 49% in 1971.

Barite.—Output of barite was down slightly, but Missouri was again the largest producer of barite in the Nation. Most Missouri barite continued to go to grinding plants where it was prepared for use in drilling fluids.

The Missouri Geological Survey in a cooperative effort with the U.S. Bureau of Mines, completed an extensive study of barite tailings ponds in Washington County. Four ponds were test drilled as a basis for evaluating the barite ore potential in tailings ponds. The amounts and size-grade distribution of barite in these four ponds were itemized in a report[6] along with assay maps and a location map. The barite in the tailings, estimated at nearly 2 million tons, accumulated from 30 years of barite mining and washing in Washington County. This quantity is about a sixth of the total district output to date of 11.5 million tons of concentrate and is equivalent to about a 10-year supply at the present rate of production.

Cement.—Seven cement plants were operated by six companies in Missouri during 1971 at near capacity to produce about 4-½ million tons of cement. A high level of construction activity throughout the Mississippi River Valley provided the principal market for Missouri's cement.

Ten new, specially-designed cement barges were delivered to Dundee Cement Co. at its Clarksville Plant. The new barges, with a capacity of 1,500 tons each,

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[4] Gerdemann, P. E., and H. E. Myers. Relationships of Carbonate Facies Patterns to Ore Distribution and to Ore Genesis in the Southeast Missouri Lead District. Econ. Geol., v. 67, June-July 1972, pp. 426–433.

[5] Kisvarsanyi, Eva B. Petrochemistry of a Precambrian Igneous Province, St. Francois Mountains, Missouri. Missouri Geol. Sur. RI 51, 1972, 103 pp.

[6] Wharton, H. M. Barite Ore Potential of Four Tailings Ponds in the Washington County Barite District, Missouri. Missouri Geol. Sur. RI 53, 1972, 91 pp.

Table 6.—Missouri: Portland cement statistics

(Short tons)

	1971	1972
Number of active plants	7	7
Production	4,143,556	4,328,860
Shipments from mills:		
Quantity	4,515,142	4,277,339
Value	$77,567,579	$80,897,790
Stocks at mills, Dec. 31	287,685	417,988

Table 7.—Missouri: Masonry cement statistics

(Short tons)

	1971	1972
Number of active plants	6	5
Production	73,582	84,529
Shipments from mills:		
Quantity	72,555	80,016
Value	$1,628,964	$1,858,502
Stocks at mills, Dec. 31	8,337	13,189

will greatly increase shipping capacity from the plant. Dundee is the first major cement company in its marketing area to produce portland-pozzolan cement through a specially formulated intergrinding procedure. Large supplies of fly ash serve as the pozzolanic component in the cement.

Clays.—Production of clays was steady with output of both fire clay and common clay up moderately, and the total value of all clays also was moderately higher than in 1971.

Records of the Missouri Land Reclamation Commission indicate that about 180 acres were affected by surface mining of clay and shale, including clay and shale for cement manufacture.

A history of Missouri's brick industry was published.[7]

Lime.—Missouri was the second largest lime producer in the Nation. Mississippi Lime Co., Ash Grove Cement Co., Valley Mineral Products Corp., and Marblehead Lime Co. produced lime in Green, Marion, St. Francois, and Ste. Genevieve Counties. Output increased 12% and was 10% above the 1969 record. The lime was used for steel furnaces, water purification, paper and pulp, refractories, and other uses. The lime was used in Indiana, Illinois, Kentucky, Missouri, Ohio, and many other States. Total lime consumption in Missouri was 208,300 tons.

Sand and Gravel.—Sand and gravel production declined slightly in Missouri during 1972. Most of this decrease was in construction aggregates; production of industrial sand was basically unchanged. A leveling off in construction and a decline in the federally-sponsored road building program were thought to be the main reason for the drop in production.

Permits issued by the Missouri Land Reclamation Commission indicate that about 230 acres were affected by surface mining of sand and gravel.

Stone.—Missouri ranked sixth among the States in stone output. Total stone production increased about 3% in 1972. The only increase was in stone production for lime manufacture.

City Quarries, a division of Raid Quarries Corp., installed a heavy media separation facility at their Boon County quarry. Reports indicated that the unit was successful in removing chert from the Burlington Limestone.

Permits issued by the Missouri Land Reclamation Commission indicate that about 750 acres were disturbed by surface mining of stone in 1972.

The Carthage Marble Corp. reported

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[7] Missouri Geological Survey. There's a New Market For Old Bricks. Missouri Min. News, v. 12, No. 5, May 1972, pp. 80–83.

Table 8.—Missouri: Clays sold or used by producers, by kind

(Thousand short tons and thousand dollars)

	Fire Clay		Common Clay		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1968	1,064	4,334	1,369	1,824	2,433	6,158
1969	1,040	4,968	1,211	1,437	[2] 2,251	[2] 6,405
1970	927	4,854	1,201	1,626	[3] 2,128	[3] 6,480
1971	872	4,896	1,440	2,558	[4] 2,354	[4] 7,454
1972	894	5,512	1,677	3,583	[4] 2,571	[4] 9,096

[1] Data may not add to totals shown because of independent rounding.
[2] Excludes bentonite and fuller's earth.
[3] Excludes fuller's earth.
[4] Excludes bentonite and kaolin.

Table 9.—Missouri: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,587	4,095	3,759	3,989
Fill	275	197	341	242
Filtration	W	W	4	W
Glass	W	W	697	2,237
Paving	1,624	1,576	1,597	1,707
Other uses [1]	1,414	4,970	490	2,243
Total [2]	6,901	10,839	6,888	10,420
Gravel:				
Building	1,853	2,659	1,682	2,375
Fill	39	21	31	29
Paving	1,372	1,414	1,280	1,671
Miscellaneous	W	W	162	252
Other uses [3]	98	98	25	32
Total [2]	3,362	4,192	3,180	4,358
Government-and-contractor operations:				
Sand:				
Fill	1	1	--	--
Paving	17	18	(4)	(4)
Total	18	19	(4)	(4)
Gravel:				
Fill	1	1	--	--
Paving	40	55	7	17
Other Uses	6	4	7	10
Total	47	60	14	27
Total sand and gravel [2]	10,327	15,109	10,082	14,806

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes railroad ballast (1971), ground and unground, and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1972).

[4] Less than ½ unit.

Table 10.—Missouri: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone	8	W	7	W
Crushed and broken:				
Bituminous aggregate	1,990	3,253	2,559	4,066
Concrete aggregate	7,018	10,374	5,694	9,501
Dense graded road base stone	6,998	9,734	5,081	8,118
Macadam aggregate	1,564	2,427	2,606	3,541
Stone sand	126	319	146	384
Surface treatment aggregate	2,364	3,504	2,336	4,280
Unspecified construction aggregate and roadstone	2,979	5,015	3,399	6,000
Agricultural purposes [1]	3,315	5,746	4,136	7,595
Cement and lime manufacture	10,943	17,105	10,799	10,446
Mineral fillers, extenders, and whiting	141	W	174	975
Railroad ballast	W	W	W	62
Riprap and jetty stone	1,898	1,969	3,688	3,242
Other [2]	1,754	5,326	1,849	5,009
Total [3]	41,099	64,772	42,473	63,219

W Withheld to avoid disclosing individual company confidential data; crushed and broken data withheld; included with "Other."

[1] Data include agricultural limestone and poultry grit.

[2] Includes stone for terrazzo, roofing aggregate, filter stone, flux stone, chemicals, mine dusting, abrasives glass, ferrosilicon, and uses not specified.

[3] Data may not add to totals shown because of independent rounding.

Table 11.—Missouri: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension granite	W	W	2	358
Crushed and broken:				
Limestone [1]	40,244	68,044	41,679	60,440
Sandstone	W	W	221	W
Other stone [2]	855	1,727	571	2,779
Total	41,099	[3] 64,772	42,473	[4] 63,219

W Withheld to avoid disclosing individual company confidential data; included with "Other stone."

[1] Limestone used generally to include dolomite.

[2] Includes stone sold or used for marble, crushed and broken traprock and granite, and quantity data for dimension sandstone and limestone. Value data for dimension stone not included.

[3] Data do not add to total shown because of independent rounding.

[4] Value data represent crushed and broken stone only.

that the underground storage area in the mined out part of its southeast Missouri mine was being expanded by more than 1 million square feet (from 100,000 square feet previously used). Access to the area is by horizontal adits through which both trucks and railroads can operate. The area already developed is enclosed by concrete block walls with fireproof doors and has a dehumidifying system. The storage area ceiling is of natural rock and the floor is 5-inch-thick concrete. Already stored in the area are such items as bed springs, bagged fertilizer, and several million pounds of food.

Sulfur.—Two lead smelters in the State recovered substantial tonnages of byproduct sulfur as sulfuric acid. St. Joe Minerals Corp. operated an acid plant at its Herculaneum smelter and Amax Lead Company of Missouri (formerly Missouri Lead Operating Co.), also recovered sulfuric acid at its lead smelter near Boss.

METALS

Metals accounted for about 50% of the total value of State mineral output, a 22% increase over 1971 values. The increase in production of lead, with byproduct silver, copper, and zinc, was the main factor in this gain.

Aluminum.—Noranda Aluminum had its first full year of full-scale operation at its aluminum smelter near New Madrid in the bootheel area of southeast Missouri. The plant has an estimated capacity of about 70,000 tons of aluminum metal per year and is designed to increase capacity in increments of 70,000 tons up to a total of 210,000 tons per year. An adjacent rod, wire, and cable plant takes approximately one-third of the annual metal output for fabrication into electrical cable products. The remaining two-thirds is shipped as extrusion billet, sheet ingot, or casting ingot.

Iron Ore.—Iron ore output from Missouri's two underground iron mines remained steady at just under 3 million tons of high-grade pellets.

Meramec Mining Co. reported a slightly higher production at 1,881,000 tons of pellets from its Pea Ridge mine near Sullivan. The increased output was achieved by mining higher grade ore and utilizing additional mobile, trackless mining equipment. This underground mine was approaching its capacity of 2 million tons of pellets per year. Four types of iron ore products are shipped: (1) Standard-grade iron pellets, (2) "super pellets" with less than 0.25% silica, (3) special high-grade iron ore for ferrite manufacture, and (4) special grade iron ore concentrates for heavy media use in the coal industry. In 1972 Meramec began to ship apatite recovered as a byproduct of the iron ore production. The company also was investigating means of concentrating monazite, which occurs in the ore, and possible uses for pyrite and hematite byproducts. An increase in the price of iron ore pellets of 73 cents per long ton was implemented December 12, 1972.

Mine and plant modifications at the Pilot Knob Pellet Co. included a new underground operations control center, replacement of 10-inch cyclones at the concentrating plant with 26-inch units, and a new system to pump coarse tailings from the mill to mined-out stopes where the material is used for ground support.

Lead.—The 1972 production of nearly

Table 12.—Missouri: Ferrous scrap and pig iron consumption

(Thousand short tons)

Year	Ferrous scrap	Pig iron	Total scrap and pig iron
1968	1,049	24	1,073
1969	1,058	20	1,078
1970	1,062	21	1,083
1971	W	17	W
1972	W	W	W

W Withheld to avoid disclosing individual company confidential data.

490,000 tons of lead contained in ore and concentrate was a record high for Missouri and represented nearly 80% of total U.S. output.

Production of lead concentrate by St. Joe Minerals increased to 312,662 tons from 303,190 in 1971. Lead and lead alloy production at the Herculaneum smelter at 207,877 tons was off from the 222,213 tons in 1971, owing to a strike in April.

In September 1972, Amax Lead & Zinc, Inc. moved its headquarters from New York to Clayton, Mo., closer to its customers in the midwest area, its new smelter at Sauget, Ill., and its operating facilities in southeast Missouri.

The operations of the mine-mill-smelter complex of Amax Lead Company of Missouri, jointly owned by Amax and Homestake Mining Co., benefited from improved production and favorable ore grade. During 1972, some 1,447,000 tons of ore was mined and milled, and 189,000 tons of lead concentrate and 82,000 tons of zinc concentrate were produced. The smelter produced 133,000 tons of refined lead, compared with 109,000 tons in 1971. Of the total output of refined lead, 33,500 tons was for the account of Amax, an identical amount for Homestake, and the balance was refined on toll for other producers. Zinc concentrates were shipped to Amax's Blackwell zinc smelter in Oklahoma for treatment.

Silver.—Production of silver (a byproduct of lead-zinc production) increased nearly 19% in 1972 to 1.97 million ounces. this made Missouri the Nation's sixth largest producer of silver with 5.3% of the total.

Zinc.—An increase of about 14,000 tons of zinc metal equivalent over the previous year brought Missouri's output to its highest level since World War I and made Missouri the third largest producer in the Nation, after Tennessee and Colorado.

Table 13.—Missouri: Tenor of lead ore milled and concentrates produced in 1972

Total material	short tons	8,485,769
Metal content of ore:[1]		
Copper	percent	0.14
Lead	do	5.77
Zinc	do	0.73
Concentrates produced and average content:		
Copper-lead	short tons	22,962
Recovery ratio	percent	0.27
Average copper content	do	26.55
Average lead content	do	9.26
Lead	short tons	692,176
Recovery ratio	percent	8.16
Average lead content	do	72.31
Zinc	short tons	126,036
Recovery ratio	percent	1.49
Average zinc content	do	55.24

[1] Figures represent metal content of crude ore only as recovered in the concentrate.

Table 14.—Missouri: Mine production (recoverable) of silver, copper, lead, and zinc

	1970	1971	1972
Mines producing:			
Lode	11	14	10
Material sold or treated:			
Ore .... thousand short tons	8,821	8,625	8,486
Barium sulfate .... do	5	--	--
Lead .... do	8,816	8,625	8,486
Production (recoverable):			
Quantity:			
Silver .... troy ounces	1,816,978	1,660,879	1,971,530
Copper .... short tons	12,184	8,445	11,509
Lead .... do	421,764	429,634	489,397
Zinc .... do	50,721	48,215	61,923
Value:			
Silver .... thousand dollars	3,218	2,568	3,322
Copper .... do	14,003	8,783	11,785
Lead .... do	131,751	118,579	147,113
Zinc .... do	15,540	15,525	21,983
Total .... do	[1] 164,511	145,455	184,203

[1] Data do not add to total shown because of independent rounding.

Table 15.—Total value of mineral production in Missouri and production and value of lead in Missouri and the United States

(Short tons and thousand dollars)

Year	Total value of Missouri mineral production	Lead production					
		Missouri				United States	
		Quantity	Value	Percent of U.S. production	Percent of world production	Quantity	Value
1968	276,238	212,611	56,180	59.2	6.4	359,156	94,903
1969	367,232	355,452	105,889	69.8	10.1	509,018	151,635
1970	392,996	421,764	131,751	73.8	11.3	571,767	178,609
1971	400,089	429,634	118,579	74.3	15.0	r 578,550	159,679
1972	451,817	489,397	147,113	79.1	12.7	618,915	186,046

r Revised.

MINERAL FUELS

Mineral fuels accounted for about 5% of the State's total mineral value. Coal continued to be the main component in the energy group.

Fuel resources in Missouri include bituminous coal, oil, and gas, and potential hydrocarbon production from tar sands in western Missouri. Bituminous coal is the only mineral fuel commodity with both current importance and a potential for increased utilization in the future.

Petroleum and Natural Gas.—Missouri had 137 producing oil wells and two producing gas wells in 1972. Only five holes were drilled in the State during 1972, four of these were dry and one was a service well.

Feasibility studies for construction of a synthetic gas plant in northern Newton County were being made by Cities Service Gas Co. of Oklahoma City. The plant under consideration would convert naphtha to synthetic gas at a rate of 125 million cubic feet of gas per day which would be added to the company's pipeline system as a supplemental supply.

Laclede Gas Co. of St. Louis was constructing new underground liquid propane storage facilities in north St. Louis County. The mined cavern storage area, nearly 400 feet beneath the surface, consists of a network of interconnecting tunnels extending over an area of about 15 acres. It has a capacity of about 800,000 barrels of liquid propane. Openings average about 20 feet with pillars measuring 45 feet by 45 feet. Access was by a shaft measuring 60 inches in diameter, which was to be sealed after the propane is injected. The propane will be stored at about 60° under 100 pounds pressure. Total cost for the storage facility was nearly $5 million. Laclede's cavern is one of three such storage areas in Missouri. Others are in Lawrence County and Jasper County.

Laclede Gas Co. was authorized by the

Missouri Public Service Commission (PSC) to pass on to its customers the cost of exploration for natural gas, up to a limit of 2½% of yearly operating expenses. This is the first time that a gas distributor in Missouri has asked and been allowed to go into the production business at the consumer's expense. It is considered by some to be a controversial step because "it forces customers to finance what might be a risk venture." The PSC said it approved the company's request so that Laclede can obtain more gas at a time when there are serious shortages of fuel.

Coal.—Production of coal increased 13% in 1972 over 1971 figures.

Missouri ranks 12th in the Nation with bituminous coal reserves of 50 billion tons. Of this total, 12.3 billion tons are classed as minable reserves. Coal-bearing strata cover approximately 24,000 square miles in northern and western Missouri. While more than 40 beds are known to exist, fewer than half of them have been mined, and only 13 are of sufficient thickness and areal extent to be minable.

Coal output increased about 55% since 1961, the result of two additional mines being developed. The new Midway mine of Pittsburgh and Midway Coal Co. in Bates County will be in full operation by early 1973. It will be the largest coal mine in the State, adding about 2.4 million tons annually to the present production of 4.6 million tons.

Missouri Mining, Inc., a subsidiary of Ohio Coal and Construction Co., began strip mining coal in Putnam County near Unionville, with plans to ship 25 carloads of coal per week to a power firm in Iowa.

Peabody Coal Co. ceased mining at its Mark Twain mine in Boone County north of Columbia because of depletion of reserves that could be mined with available equipment.

In 1968 the Missouri Geological Survey entered into an agreement with the National Air Pollution Control Administration to survey Missouri's coal resources in a 3-year two-phase research program. Stage I was completed in June 1970 and resulted in publication of the Missouri Geological Survey RI 48 "Evaluation of Missouri's Coal Resources." That report includes resource estimates by seam, thickness, and sulfur content, and maps showing areas favorable for exploration and development. Stage II was a followup detailed investigation of coal resources in potentially important areas, with sampling and evaluation drilling and emphasis on minable reserves. A report summarizing results was in process in 1972.

Union Electric Co., (UE) announced plans to borrow $130 million to finance its construction program. The funds will build new 600,000-kilowatt coal-burning generating units at Labadie and Rush Island, the two new coal-burning steam powerplants west and south of St. Louis. UE continued to study the possibility of building a 1,200,000-kilowatt nuclear powerplant in Missouri. With regard to environmental control costs, officials of the company said that the use of low-sulfur fuels is expected to add $80 million in costs in the next 5 years. UE's generating capacity at the end of 1972 was 5,492,000 kilowatts compared with 4,897,000 kilowatts the previous year.

Table 16.—Missouri: Bituminous coal production from strip mines, by county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines	Production (thousand short tons)	Value (thousands)
Barton	1	585	W
Bates	1	103	W
Boone	1	374	W
Callaway	1	22	W
Henry	2	1,898	W
Macon	1	1,010	W
Putnam	1	105	W
Randolph	1	446	W
Vernon	2	8	W
Total	11	4,551	$23,667

W Withheld to avoid disclosing individual company confidential data included in "Total."

Table 17.—Principal producers

Commodity and company	Address	Type of activity	County
Asphalt, native:			
Bar-Co-Roc Asphalt Co.	P.O. Box 11 Iantha, Mo. 64753	Mine	Barton.
Silica Rock Asphalt Corp.	Sheldon, Mo. 64784	do	Vernon.
Barite:			
Dresser Minerals Div.	P.O. Box 6504 Houston, Tex. 77005	do	Washington.
Milchem, Incorporated	P.O. Box 22111 Houston, Tex. 77027	Mine and mill	Do.
N L Industries, Inc., Baroid Division.	P.O. Box 1675 Houston, Tex. 77001	do	Do.
N L Industries, Inc., DeLore Division.	P.O. Box 2808 Carondelet Sta. St. Louis, Mo. 63111	Mill	St. Louis.
Pfizer & Co.	Box 47 Mineral Point, Mo. 63660	Mine and mill	Washington.
Cement:			
Alpha Portland Cement Co.	15 South Third St. Easton, Pa. 18043	Plant and quarry	St. Louis.
Dundee Cement Co.	P.O. Box 317 Dundee, Mich. 48131	do	Pike.
Marquette Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	do	Cape Girardeau.
Missouri Portland Cement Co.	7751 Carondelet Ave. St. Louis, Mo. 63105	do	Jackson and St. Louis.
River Cement Co.	Festus, Mo. 63028	do	Jefferson.
Universal Atlas Cement Div. of U.S. Steel Corp.	600 Grant St. Pittsburgh, Pa. 15230	do	Ralls.
Clay and shale:			
Allied Chemical Corp.	Box 70 Morristown, N.J. 07960	Mine and plant	Gasconade.
Alton Brick Co.	Box 1025 Maryland Heights, Mo. 63042	do	St. Louis.
Carter-Waters Corp.	2440 Pennway Kansas City, Mo. 64108	do	Platte.
C-E Refractories Div. of Combustion Engineering.	101 Ferry St. St. Louis, Mo. 63147	do	Callaway, Monroe, Montgomery.
Dundee Cement Co.	Dundee, Mich. 48131	do	Pike.
U.S. Gypsum: A. P. Green Refractories Co.	Mexico, Mo. 65265	do	Franklin and Gasconade.
Dresser Industries Inc.: Harbison-Walker Refactories Co.	2 Gateway Center Pittsburgh, Pa. 15222	do	Audrain, Callaway, Gasconade, Lincoln, Montgomery, St. Charles, Warren.
Kaiser Refractories	P.O. Box 499 Mexico, Mo. 65265	do	Audrain, Callaway, Gasconade, Montgomery, Osage, Warren.
Marquette Cement Mfg. Co.	20 North Wacker Dr. Chicago, Ill. 60606	do	Cape Girardeau.
Midland Brick & Tile Co.	Box 428 Chillicothe, Mo. 64601	do	Livingston.
Missouri Portland Cement Co.	7751 Carondelet Ave. St. Louis, Mo. 63105	do	Jackson and St. Louis.
H. K. Porter Co., Inc.	4705 Ridgewood Ave. St. Louis, Mo. 63116	do	Callaway, Gasconade, Monroe.
Universal Atlas Cement Div., U.S. Steel Corp.	P.O. Box 2969 Pittsburgh, Pa. 15230	do	Ralls.
Wellsville Fire Brick Co.	West Highway 19 Wellsville, Mo. 63384	do	Audrain and Montgomery.
Coal:			
Clayton-Hensley Coal Co.	Route 3 Fulton, Mo. 65251	Strip mine	Callaway.
Ellis Coal Co.	Bronaugh, Mo. 64728	do	Vernon.
Peabody Coal Co.	301 North Memorial Dr. St. Louis, Mo. 63102	do	Boone, Henry, Macon, Randolph.
Copper: *See* Lead.			
Iodine (consumers):			
Hoffman-Taff, Inc.	West Bennett Rd. Springfield, Mo. 65800	Plant	Greene.
Mallinckrodt Chemical Works.	3600 North Second St. St. Louis, Mo. 63147	do	St. Louis.
West Argo-Chemical, Inc.	42-16 West St. Long Island, N.Y. 11101	do	Jackson.

Table 17.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Iron ore:			
Meramec Mining Co	Route 4 Sullivan, Mo. 63080	Underground mine	Washington.
Pilot Knob Pellet Co	Box 26 Ironton, Mo. 63650	do	Iron.
Lead:			
Cominco American, Inc	Box 430, Salem, Mo. 65560	do	Do.
Amax Lead Co. of Mo	Boss, Mo. 65440	do	Do.
Ozark Lead Co	Sweetwater, Mo. 63680	do	Reynolds.
St. Joe Minerals Corp	Boone Terre, Mo. 63628	do	Crawford, Iron, Reynolds, St. Francois, Washington.
Lime:			
Ash Grove Cement Co	1000 Ten Main Center Kansas City, Mo. 64105	Plant	Greene.
Marblehead Lime Co	300 West Washington Chicago, Ill. 60606	do	Marion.
Mississippi Lime Co	7 Alby St. Alton, Ill. 62002	do	Ste. Genevieve.
Valley Mineral Products Corp.	915 Olive St. St. Louis, Mo. 63101	do	St. Francois.
Perlite: (Expanded)			
J. J. Brouk & Co	1367 South Kingshighway Blvd. St. Louis, Mo. 63110	Expanding plant	St. Louis.
Roofing granules:			
GAF Corp	Box 278 Annapolis, Mo. 63620	Plant	Iron.
Sand and gravel:			
Eureka Sand & Gravel Co.	Rt. 1, Box 77 Eureka, Mo. 63025	Stationary	St. Louis.
Holliday Sand & Gravel Co.	6811 West 63rd St. Overland Park, Kans. 66202	Dredge	Various.
Missouri Gravel Co	813 16th St. Moline, Ill. 61265	do	Lewis.
Norbroco, Inc	P.O. Box 414 Hazelwood, Mo. 63042	do	St. Louis.
Pennsylvania Glass Sand Corp.	Berkeley Springs, W. Va. 25411	Stationary	St. Louis and St. Charles.
Riverside Sand & Dredging.	5000 Bussen Rd. St. Louis, Mo. 63129	Dredge	St. Louis.
Simpson Sand Gravel Co	15 Lookout Drive Valley Park, Mo. 63088	do	Jefferson.
St. Charles Sand Co	Rt. 1, Box 253 Bridgeton, Mo. 63042	Stationary	St. Louis.
Williamsville Stone Co	P.O. Box 234 Poplar Bluff, Mo. 63901	Stationary and portable	Butler.
Winter Bros. Material Co.	13098 Gravois Rd. St. Louis, Mo. 63127	Stationary	St. Louis.
Silver: *See* Lead.			
Stone:			
Brown Quarries	Washington, Mo. 68090	Quarry	Various.
Bussen Quarries, Inc	5000 Bussen Rd. St. Louis, Mo. 63129	do	Jefferson and St. Louis.
Dundee Cement Co	P.O. Box 317 Dundee, Mich. 48131	do	St. Louis.
Midwest Precote Co	7600 East 17th St. Kansas City, Mo. 64116	2 quarries	Clay and Platte.
Mississippi Lime Co	7 Alby St. Alton, Ill. 62002	Quarry	Ste. Genevieve.
Missouri Portland Cement Co.	7751 Carondelet Ave. St. Louis, Mo. 63105	do	Jackson and St. Louis.
River Cement Co	Festus, Mo. 63028	do	Jefferson.
Vigus Quarries, Inc	7929 Alabama Ave. St. Louis, Mo. 63111	do	Jefferson and St. Louis.
West Lake Quarry & Material Co.	Rt. 1, Box 206, Taussig Rd. Bridgeton, Mo. 63042	do	St. Louis and Scott.
Vermiculite:			
W. R. Grace & Co., Zonolite Div.	62 Whittemore Ave. Cambridge, Mass. 01109	Exfoliating plant	St. Louis.
Zinc: *See* Lead.			

The Mineral Industry of Montana

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Montana Bureau of Mines and Geology for collecting information on all minerals.

By J. R. Welch[1]

In 1972, Montana mineral production was valued at $307.7 million, an increase of 7.9% compared with the 1971 value. The 1972 value of copper rose 37% compared with that of the previous year. Other metals showing significant increases in value of production were gold, 116% and silver, 32%.

Petroleum and natural gas production values remained about the same as in 1971. Coal continued its upward trend with an increase in production value of 30%.

During the year, the Northern Plains Resource Council was formed, and had as its goal the provision to its members of information on coal development. The council plans to support stringent land reclamation bills, and to seek a moratorium on strip mining. By yearend, the council had filed suit against the Montana Board of Health to stop construction of two coal-fired electric generating plants at Colstrip, Mont.

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[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in Montana[1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Antimony ....short tons..	135	$81	W	W
Clays[2] ....thousand short tons..	264	1,712	304	$1,590
Coal (bituminous and lignite) ....do....	7,064	12,817	8,221	16,690
Copper (recoverable content of ores, etc.) ..short tons..	88,581	92,125	123,110	126,064
Gem stones	NA	114	NA	120
Gold (recoverable content of ores, etc.) ....troy ounces..	15,613	644	23,725	1,390
Iron ore (usable) ...thousand long tons, gross weight..	14	W	9	W
Lead (recoverable content of ores, etc.) ....short tons..	615	169	287	86
Lime ....thousand short tons..	199	2,416	242	3,003
Manganese ore and concentrate (35% or more Mn) short tons, gross weight..	142	W	578	W
Natural gas ....million cubic feet..	32,720	3,959	33,474	4,117
Peat ....thousand short tons..	W	W	1	W
Petroleum (crude) ....thousand 42-gallon barrels..	34,599	104,128	33,904	103,924
Sand and gravel ....thousand short tons..	15,781	25,207	10,116	17,149
Silver (recoverable content of ores, etc.) thousand troy ounces..	2,748	4,248	3,325	5,608
Stone ....thousand short tons..	W	W	4,074	5,627
Zinc (recoverable content of ores, etc.) ....short tons..	361	116	12	4
Value of items that cannot be disclosed: Cement, fire clay, fluorspar, gypsum, natural gas liquids, phosphate rock, talc, vermiculite, tungsten ore and concentrate, and values indicated by symbol W	XX	37,337	XX	22,309
Total	XX	285,073	XX	307,676
Total 1967 constant dollar	XX	242,398	XX	[p] 255,956

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Values of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Montana, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Beaverhead	$540	W	Sand and gravel, stone, silver, gold, copper, lead.
Big Horn	4,742	W	Coal, sand and gravel, petroleum, stone, natural gas.
Blaine	459	$289	Petroleum, natural gas, sand and gravel.
Broadwater	W	W	Iron ore, sand and gravel, stone.
Carbon	6,135	5,225	Petroleum, clays, natural gas, sand and gravel.
Carter	W	W	Clays, petroleum, sand and gravel.
Cascade	4,273	188	Sand and gravel, clays.
Chouteau	W	W	Sand and gravel, stone.
Custer	W	W	Sand and gravel, natural gas, stone.
Daniels	762	32	Petroleum, sand and gravel.
Dawson	2,317	W	Petroleum, sand and gravel, stone.
Deer Lodge	2,695	3,768	Lime, stone, sand and gravel, manganese ore, tungsten, clays, silver, copper, gold.
Fallon	21,435	22,986	Petroleum, natural gas, natural gas liquids.
Fergus	W	W	Sand and gravel, gypsum, clays, stone.
Flathead	565	491	Sand and gravel, silver, lead, copper, gold.
Gallatin	W	W	Cement, sand and gravel, stone, clays.
Garfield	30	1,069	Sand and gravel, stone.
Glacier	2,219	2,314	Petroleum, natural gas liquids, sand and gravel.
Golden Valley	37	.7	Sand and gravel.
Granite	431	W	Silver, gold, copper, sand and gravel, tungsten, stone.
Hill	W	W	Sand and gravel, stone.
Jefferson	W	5,815	Cement, stone, sand and gravel, silver, lead, copper, gold, clays, zinc.
Lake	W	W	Sand and gravel, peat, stone.
Lewis and Clark	548	257	Sand and gravel, silver, lead, copper, gold.
Liberty	1,368	1,167	Petroleum, natural gas, sand and gravel.
Lincoln	12,277	5,483	Vermiculite, sand and gravel, stone.
McCone	858	2,101	Petroleum, sand and gravel, stone.
Madison	W	W	Talc, sand and gravel, gold, silver, copper, lead.
Meagher	W	30	Sand and gravel.
Mineral	W	1,392	Sand and gravel, stone, silver, copper, gold, lead.
Missoula	237	W	Stone, sand and gravel, copper, lead, silver.
Musselshell	2,551	3,689	Petroleum, coal, sand and gravel.
Park	W	W	Sand and gravel, stone.
Petroleum	5	101	Do.
Phillips	549	14	Sand and gravel.
Pondera	4,037	419	Sand and gravel, petroleum, stone.
Powder River	19,134	20,193	Petroleum, natural gas, sand and gravel, coal, stone.
Powell	W	W	Phosphate rock, sand and gravel, stone.
Ravalli	W	W	Fluorspar, sand and gravel, stone.
Richland	7,142	8,707	Petroleum, sand and gravel, coal, lime, stone.
Roosevelt	5,369	W	Petroleum, sand and gravel, stone.
Rosebud	14,283	16,920	Coal, petroleum, sand and gravel, clays, stone.
Sanders	371	W	Sand and gravel, stone, antimony.
Sheridan	6,725	W	Petroleum, sand and gravel.
Silver Bow	96,448	133,264	Copper, silver, gold, sand and gravel, stone, lead.
Stillwater	134	64	Natural gas, stone.
Sweet Grass	6	W	Sand and gravel.
Teton	356	W	Sand and gravel, petroleum, stone.
Toole	2,291	8,001	Petroleum, sand and gravel, natural gas, stone.
Treasure	W	W	Clays, sand and gravel.
Valley	W	W	Sand and gravel, stone.
Wibaux	W	W	Sand and gravel.
Yellowstone	2,884	1,388	Sand and gravel, lime, stone, petroleum, clays.
Yellowstone National Park	1,126	567	Sand and gravel.
Combined counties[2]	30,813	27,081	
Undistributed[3]	29,921	39,639	
Total[4]	285,078	307,676	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Judith Basin, Prairie, and Wheatland Counties are not listed because no production was reported.

[2] Petroleum and natural gas production from fields underlying two or more counties.

[3] Includes mineral production which cannot be assigned to specific counties and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

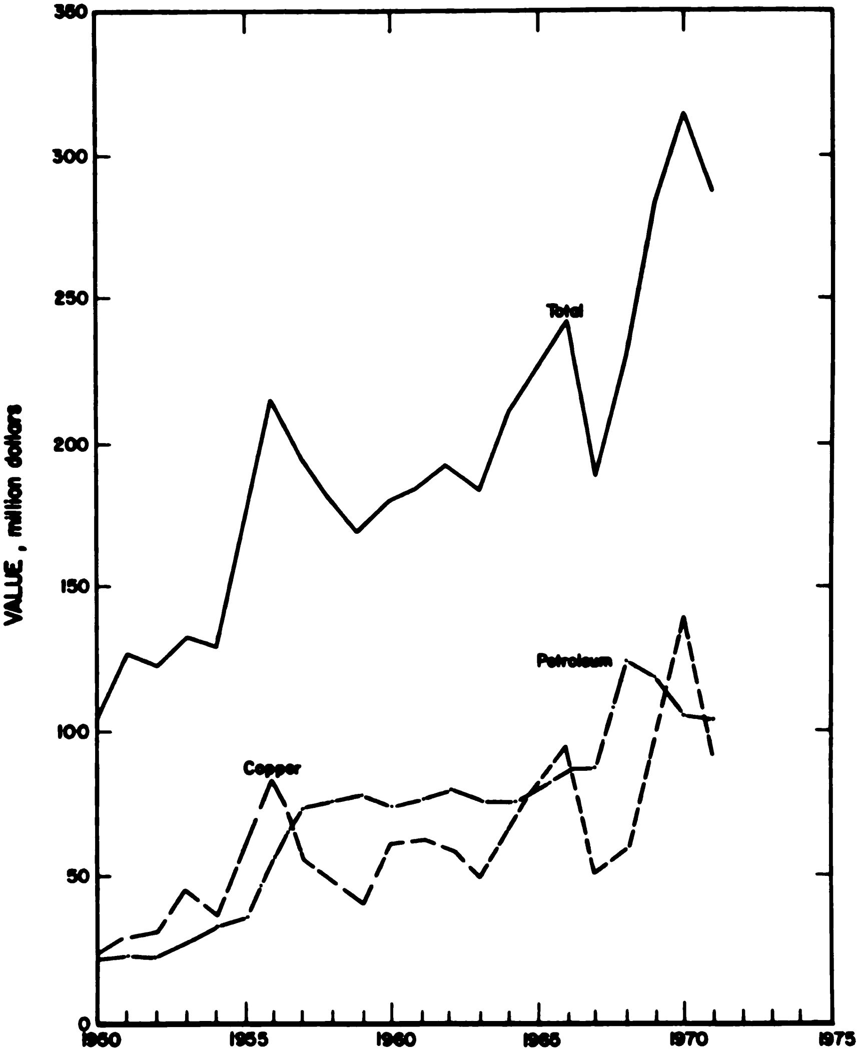

Figure 1.—Value of copper, petroleum, and total value of mineral production in Montana.

New reclamation laws, considered more stringent than the existing laws, were drafted and were planned to be submitted to the 1973 Legislature. The new bill, "The Montana Reclamation Act" would grant authority to the State to control the method of mining, to regulate mining in precipitious terrain, to increase bonding to a maximum of $5,000 per acre, to deny mining permits, to review mining permits on an annual basis, and to permit lawsuits by citizens and to provide other changes in "The Montana Open Cut or Strip Mined Land Reclamation Act."

Montana's occupational health and safety program gained Federal approval. Thus, Montana, acting through its Workmen's Compensation Division, was the first State to receive a Federal grant ($300,000) to implement its own health and safety program (MOSHA).

During the year, The Anaconda Company filed suit in the U.S. District Court in Denver asking that enforcement of federally imposed air pollution standards for Anaconda's smelter be stopped. The proposed Federal rules applying to the Anaconda smelter in Montana would require the company to cut emissions of sulfur dioxide 89%. As a result of the suit, the company gained a favorable ruling.

Table 3.—Indicators of Montana business activity

	1971	1972 [p]	Change, percent
Employment and labor force annual average:			
Total labor force ....thousands..	293.0	297.4	+1.5
Unemployment ....do....	20.1	22.6	+12.4
Employment:			
Manufacturing ....do....	24.0	24.9	+3.8
Wholesale and retail trade ....do....	50.1	51.5	+2.8
Mining ....do....	5.4	6.1	+13.0
Construction ....do....	11.7	10.4	−11.1
Transportation and public utilities ....do....	17.7	17.9	+1.1
Finance, insurance, and real estate ....do....	8.5	8.8	+3.5
Services ....do....	35.3	36.9	+4.5
Government ....do....	54.4	55.5	+2.0
Personal income:			
Total ....millions....	$2,575	$2,802	+8.8
Per capita	$3,629	$3,897	+7.4
Construction activity:			
Value of authorized nonresidential construction ....millions..	$18.8	$30.2	+60.6
Highway construction contracts awarded ....do....	$67.2	[e] $75.0	+11.6
Cement shipments to and within Montana thousand short tons..	308	245	−20.4
Farm marketing receipts ....millions..	$694.8	$865.2	+24.5
Mineral production value ....do....	$285.1	$307.7	+7.9

[e] Estimate. [p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

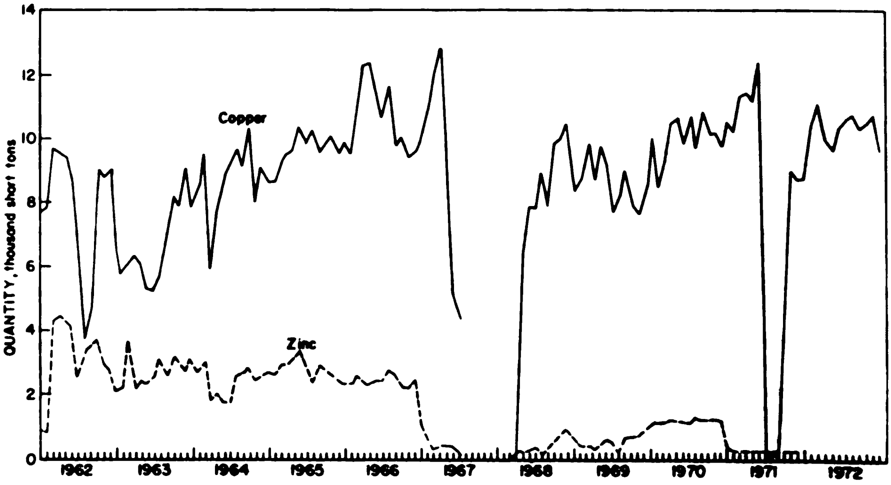

Figure 2.—Mine production of copper and zinc in Montana, by months, in terms of recoverable metal.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	168	308	52	412	--	4	4.85	NA
Metal	3,646	237	865	6,899	1	132	19.28	1,634
Nonmetal	454	273	124	990	--	38	38.37	945
Sand and gravel	938	152	142	1,177	--	31	26.34	637
Stone	466	242	113	901	--	13	14.43	303
Total	5,672	228	1,296	10,379	1	216	20.91	NA
1972:[1]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	2,815	310	878	7,007	--	148	21.12	1,257
Nonmetal	485	261	127	1,013	--	44	43.45	1,163
Sand and gravel	205	161	33	254	--	10	39.35	2,003
Stone	180	270	48	383	--	--	--	--
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

REVIEW BY MINERAL COMMODITIES

METALS

Antimony.—The U.S. Antimony Corp., subsidiary of Agau Mines, Inc., reported the adoption of a new nonpollutant refining procedure to convert antimony sulfide concentrates to metallic antimony. The company is said to be using this pollution-free process to manufacture metallic antimony.

U.S. Antimony Corp. is a fully integrated mining, milling, and refining organization, with mines located in the Prospect Creek area near Thompson Falls, Sanders County, Mont. It presently owns the second largest antimony-producing mine in the United States.

Copper.—Production of copper in Montana increased 39% from the 1971 total to 123,110 tons; value increased 37% from $92.1 million to $126.1 million in 1972. Copper was produced in 10 counties in the State. Mines of The Anaconda Company in the Butte area accounted for most of the production.

Anaconda announced that production from a new copper pit along the East Range near Butte could begin in the next 2 or 3 years. Indications were that development work at the Continental pit east of Butte would begin in 1974.[3] The company also announced the construction of a $3 million pilot plant to produce copper by a pollution-free method. The process to be employed, "The Arbiter Process," was developed by an Anaconda researcher, Nathaniel F. Arbiter, and is based on the ammonia leach method of ore extraction.

Bear Creek Mining Co., subsidiary of Kennecott Copper Corp., continued exploration and development work at its Spar Lake copper property, south of Troy, northwestern Montana.

The Environmental Protection Agency set sulfur oxide emission standards that would require Anaconda to reduce its emissions 89% at its smelter in Anaconda, Mont., by July 31, 1977, and require American Smelting and Refining Company (ASARCO) to reduce emissions 87% at its East Helena, Mont., plant by July 31, 1975.

Gold.—An increase in the average market price of gold to $58.60 per ounce and a 52% increase in production resulted in a 116% increase in the value of output to $1,390,288. Total gold production in the State was 23,725 troy ounces, approximately 95% originating as a byproduct of copper production in the Butte area, Silver Bow County. Thirty-seven mines in 10 counties contributed to the total.

The increase in the price of gold has resulted in widespread examination and reevaluation of areas in Montana that previously produced gold.

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[3] Montana Standard. Nov. 25, 1972, 1 p.

Table 5.—Montana: Mine production of gold, silver, copper, lead, and zinc in 1972, by class of ore or other source material, in terms of recoverable metal

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold and gold-silver [2]	6	6,273	668	41,273	5	57	--
Dry silver	21	12,953	270	112,267	35	212	12
Total	27	19,226	938	153,540	40	269	12
Copper and lead [2]	5	17,126,787	22,375	3,091,284	98,220	19	--
Other lode material:							
Gold cleanup, gold tailings, gold-silver tailings, silver tailings [2]	6	55,420	366	80,228	92	([3])	--
Copper precipitates	2	31,316	--	--	24,757	--	--
Total	8	86,736	366	80,228	24,849	--	--
Placer	2	--	46	--	--	--	--
Grand total [4]	39	17,232,749	23,725	3,325,052	123,110	287	12

[1] Data may not add to total because some mines produce more than one class of mineral.
[2] Combined to avoid disclosing individual company confidential data.
[3] Less than ½ unit.
[4] Data may not add to totals shown because of independent rounding.

Table 6.—Montana: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing		Material sold or treated [1] (short tons)	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1970, total	61	1	[r] 18,801,663	22,456	$817,174	4,304,326	$7,622,182
1971, total	46	3	[r] 13,573,429	15,618	644,038	2,747,557	4,247,725
1972:							
Beaverhead	5	--	1,115	27	1,582	11,355	19,134
Granite	10	--	10,581	399	23,382	60,515	101,967
Jefferson	5	--	6,035	353	20,687	41,293	69,578
Lewis & Clark	3	--	383	22	1,290	3,518	5,920
Madison	4	--	1,440	331	19,398	8,310	14,003
Meagher	--	1	--	42	2,461	--	--
Mineral	1	1	1,340	9	527	2,871	4,838
Silver Bow	5	--	17,207,921	22,535	1,320,551	3,159,482	5,323,727
Undistributed [2]	4	--	3,934	7	410	37,713	63,546
Total [3]	37	2	17,232,749	23,725	1,390,288	3,325,052	5,602,713

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1970, total	120,412	$138,955,123	996	$311,160	1,457	$446,412	$148,152,051
1971, total	88,581	92,124,812	615	169,657	361	116,115	97,302,347
1972:							
Beaverhead	1	1,199	5	1,437	--	--	23,352
Granite	15	15,303	--	--	--	--	140,652
Jefferson	31	31,349	114	34,343	12	4,303	160,260
Lewis & Clark	1	851	15	4,549	--	--	12,610
Madison	1	1,132	1	367	--	--	34,900
Meagher	--	--	--	--	--	--	2,461
Mineral	1	777	2	476	--	--	6,618
Silver Bow	123,058	126,011,137	2	588	--	--	132,656,003
Undistributed [2]	3	2,706	148	44,632	--	--	111,294
Total [3]	123,110	126,064,454	287	86,392	12	4,303	133,148,150

[r] Revised.
[1] Does not include gravel washed.
[2] Deer Lodge, Flathead, and Missoula Counties combined to avoid disclosing individual company confidential data.
[3] Data may not add to totals shown because of independent rounding.

Table 7.—Montana: Mine production of gold, silver, copper, lead, and zinc in 1972, by type of material processed and method of recovery, in terms of recoverable metal

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Smelting of concentrates	22,305	3,049,841	97,069	1	--
Direct smelting of:					
Ore	1,008	194,983	1,192	286	12
Cleanup and tailings[1]	366	80,228	92	([2])	--
Precipitates	--	--	24,757	--	--
Total	1,374	275,211	26,041	286	12
Placer	46	--	--	--	--
Grand total	23,725	3,325,052	123,110	287	12

[1] Combined to avoid disclosing individual company confidential data.
[2] Less than ½ unit.

Table 8.—Montana: Mine production of gold, silver, copper, lead, and zinc, in Silver Bow County, in terms of recoverable metal

Year	Mines producing Lode	Material sold or treated (thousand short tons)	Gold (troy ounces)	Silver (thousand troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)	Total value (thousands)
1968	6	10,089	9,782	1,466	69,362	--	--	$61,580
1969	5	16,022	15,428	2,563	103,179	--	W	103,321
1970	4	18,745	19,454	3,590	120,292	--	--	145,881
1971	4	13,531	13,789	2,415	88,508	--	--	96,344
1972	5	17,208	22,535	3,159	123,058	2	--	132,656
1882-1972	--	[1] 423,322	2,513,154	658,229	8,734,814	415,427	2,406,818	4,564,890

W Withheld to avoid disclosing individual company confidential data.
[1] Complete data not available: 1882-1904.

Iron Ore.—Minerals Engineering Co. of Denver announced that Mineral Services, Inc., of Cleveland would immediately initiate plans to develop the large Carter Creek iron ore deposit near Dillon, Mont.

The Carter Creek deposit was reported to contain 89 million tons of ore averaging 26% to 29% iron, which readily concentrates to 69% iron. Market studies were underway to determine optimum plant size and form of product to be produced.

Lead.—Lead production declined nearly 47% from 1971 to 287 tons. Mine output was reported from 18 operations throughout the State, mainly from mines in Flathead, Beaverhead, Jefferson, Lewis and Clark, Madison, Mineral, Missoula, and Silver Bow Counties.

Two small shipments of concentrates were made from the Nancy Lee lead-silver-copper-zinc mine near Superior in Mineral County. This mine was idle for about 1 year.

Silver.—The principal source of silver was as a byproduct from copper operations in the Butte area. Production rose 21% over that in 1971, and values for the year rose 32%, reflecting the increased price for silver. The average annual price for silver during 1972 was $1.69 per ounce, compared with $1.55 per ounce in 1971. Production came from 37 operations in 10 counties. Silver Bow County produced 3,159,482 ounces from five operations. Significant amounts were reported from Granite, Jefferson, Flathead, and Beaverhead Counties, bringing the total production of silver for the State to 3,325,052 ounces valued at $5.6 million.

Tungsten.—Production of tungsten concentrates increased in 1972 with the total output coming from three operations in Deer Lodge and Granite Counties. There was no production from Minerals Engineering Co. operations in Beaverhead County.

Minerals Engineering, and the General Electric Co. (GE) reached an agreement whereby GE purchased all of the company's Montana tungsten properties and its mill near Dillon. The purchase agreement was subject to ratification by stockholders.

Zinc.—The Anaconda Company announced that it had completed negotiations for the sale of its zinc fuming plant at East Helena to ASARCO. The plant was fully operational in treating slag from the ASARCO East Helena smelter. ASARCO received minor variances from the Montana Board of Health, and was granted until July 1 to design and install a system of ventilating ducts to catch fumes and particulates from the fuming plant.

During the year The Anaconda Company announced closure of its zinc smelter in Great Falls. After 63 years, the last zinc unit in operation at the Great Falls plant was shut down on August 13, 1972. Approximately 700 jobs were lost as a result of this closure. It was indicated that the stack would not be torn down, but would remain as a distinct part of the Great Falls skyline.

NONMETALS

Cement.—The quantity of portland cement shipments decreased nearly 6% in 1972 compared with that of 1971. Masonry cement shipments increased 15% for the same period. Output was from two plants, one near Helena and other at Trident. The portland and masonry cement consumed in the State totaled 241,720 tons and 2,864 tons, respectively.

Ideal Cement Co. was in the process of converting its plant at Trident from a dry to a wet manufacturing process with the installation of one new 12-foot-diameter by 450-foot-long kiln to replace four old kilns. It was reported that complete conversion would reduce dust pollution to acceptable levels and result in increasing annual production by 38,000 tons, to 329,000 tons. Computer controls were included in the $12 million expansion project.

Clays.—Output of all types of clays and shale for use in building products, iron ore pelletizing, and oil well drilling muds (bentonite) came from 13 mines in 10 counties. Miscellaneous clays and shale for making clay products, mainly face bricks, were mined by Lewiston Brick and Tile Co. in Fergus County, and by Lovell Clay Products Co. in Yellowstone County. Treasure State Industries, Inc., mined clays and shale for use in lightweight aggregate in Cascade County. International Minerals and Chemical Corp. produced bentonite from pits in Carter County for use in drilling muds, animal feed, and foundry sand. Hallett Minerals Co. operated pits in Rosebud and Treasure Counties, producing bentonite for use in iron ore pelletizing and foundry sand. NL Industries, Inc., operated pits in Carter County producing bentonite for drilling muds.

Fluorspar.—Roberts Mining Co. mined fluorspar at the Crystal Mountain mine, Ravalli County. The material, upgraded to metallurgical-grade fluorspar by milling at a heavy media separation plant at Darby, was marketed largely to the steel industry.

Gem Stones.—The value of gem stones mined increased about 5% over that in 1971. The sapphire market was reported to be active, with good-quality stones coming from the Phillipsburg area.

Gypsum.—U.S. Gypsum Co. mined and calcined gypsum in Fergus County. Output of crude gypsum increased 54%, and calcined gypsum ouput more than doubled.

Lime.—Lime production increased 22% compared with output in 1971; the value increased 24%. Lime was produced by The Anaconda Company, Great Western Sugar Co., and Holly Sugar Corp., in Deer Lodge, Richland, and Yellowstone Counties. The product was used mainly for neutralizing acid water from Anaconda's precipitation plant, for sugar refining, and for sewage treatment.

Sand and Gravel.—Sand and gravel output declined 36% to 10.1 million tons valued at $17.1 million, owing mainly to decreased demand for highway construction. There was a total of 122 producing pits in 1972.

Sand and gravel was produced in 52 of the State's 56 counties. Production exceeded 1 million tons only in Beaverhead County. The use distribution was as follows: Road material, 79%; and commercial uses, 21%.

Table 9.—Montana: Sand and gravel sold or used by producers, by class of operations and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	167	272	302	555
Fill	14	21	10	13
Paving	61	85	115	215
Other uses [1]	152	254	38	75
Total [2]	393	636	464	857
Gravel:				
Building	279	397	520	799
Fill	125	114	200	164
Paving	823	729	773	975
Miscellaneous	--	--	96	113
Other uses [3]	289	373	86	115
Total [2]	1,516	1,612	1,675	2,165
Government-and-contractor operations:				
Sand:				
Building	3	10	--	--
Fill	--	--	15	2
Paving	1,133	2,939	165	677
Other uses	8	4	7	5
Total [2]	1,143	2,954	187	684
Gravel:				
Building	40	40	60	43
Fill	198	97	239	139
Paving	12,364	19,793	7,395	13,214
Other uses	126	80	96	46
Total [2]	12,729	20,009	7,791	13,443
Total sand and gravel [2]	15,781	25,207	10,116	17,149

[1] Includes other industrial sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes railroad ballast and other gravel.

Talc.—Pfizer Inc., Cyprus Mines Corp., and American Talc Co. operated five mines, all in Madison County. The talc was ground in Beaverhead, Gallatin, and Madison Counties for use in paper (36%), paint (29%), ceramics (8%), toilet preparations (6%), and other uses (21%). Talc exports accounted for 5% of the total production. Talc production and value showed substantial increases compared with 1971.

Vermiculite.—Montana continued to supply almost two-thirds of the U.S. market for vermiculite. The Zonolite Div., W. R. Grace & Co., operated its open pit vermiculite mine in one of the world's largest vermiculite deposits, located about 6 miles northeast of Libby, Mont.

MINERAL FUELS

Coal.—Output of bituminous coal and lignite increased 16% over the 1971 level. Production came from 18 active mines, and the increase was due mainly to further expansion of coal mining facilities at Colstrip, Rosebud County.

Total coal resources in Montana (including deposits not yet discovered and identified deposits that cannot be recovered now) were reported to be about 378 billion tons. Total coal reserves in Montana (economically recoverable material in identified deposits) amounted to about 222 billion tons, of which 23 billion was strippable. Most of the coal reserves were located in eastern Montana, and were considered highly desirable because of low sulfur content.

The Montana Power Co. announced that the proposed steam-electric generating plant at Colstrip, Mont., would be doubled in size from the initially reported 350,000 kilowatts by 1975, to 700,000 kilowatts by 1976. Puget Sound Power and Light Co. of Bellevue, Wash., was to share costs and benefits. It was estimated that the two 350,000-kilowatt plants at the mine site would burn 2.5 to 3.0 million tons of coal annually, utilizing the most advanced pollution-control systems.

Table 10.—Montana: Bituminous coal production, by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

State and county	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total	
Montana (bituminous):							
Big Horn	--	1	1	--	772	772	$2,680
Musselshell	3	1	4	17	9	25	180
Rosebud	--	2	2	--	7,102	7,102	13,042
Total [1]	3	4	7	17	7,882	7,899	15,902
Montana (lignite):							
Powder River	--	1	1	--	2	2	10
Richland	--	1	1	--	320	320	777
Total	--	2	2	--	322	322	787
Total Montana [1]	3	6	9	17	8,204	8,221	16,690

[1] Data may not add to totals shown because of independent rounding.

In other developments the Consolidation Coal Co. was reportedly seeking 90,000 acres of land from the northern Cheyenne Indian tribe to establish four coal gasification plants. The land was located on the reservation a short distance south of Colstrip.

Western coals, low in sulfur content, were used increasingly to fuel powerplants in metropolitan centers of the Midwest in efforts to reduce air pollution. Nearly all the coal currently mined moved out of the State over Burlington Northern Lines to generating plants in Illinois, Indiana, Minnesota, and Wisconsin.

Petroleum and Natural Gas.—Crude petroleum recovery declined 2%, compared with the 1971 figure of 34.6 million barrels. Petroleum production amounted to 33.9 million barrels and in 1972, accounted for about 34% of the State's 1972 mineral production value. About 59% of the crude oil produced came from six fields: the Bell Creek field (6.28 million barrels), Powder River County; the Cut Bank field (4.76 million barrels), Glacier and Toole Counties; the Cabin Creek field (3.19 million barrels), Fallon County; the Pine field (2.83 million barrels), Dawson, Fallon, Prairie, and Wibaux Counties; the Pennel-Lookout Butte field (1.95 million barrels), Fallon County; and the Sumatra field (1.11 million barrels), Rosebud County.

The Bell Creek field continued as the largest source of petroleum in the State, accounting for nearly 19% of the total production. The Cut Bank field, which ranked second in 1972, remained the leading alltime producing field in Montana. Its cumulative output was 133.89 million barrels, about 17% of the total cumulative State production of 790.34 million barrels.

Secondary recovery, mostly by waterflood, continued to contribute to Montana production, and it was estimated that during 1972, one-third of the total production resulted from secondary recovery programs.

During 1972, production from the central Montana Jim Coulee field, discovered in 1971, increased to 1,400 barrels per day. The Nohly, Chelsea Creek, Second Creek, and Raymond field, all discovered in the Williston Basin area during 1972, added 1,400 barrels per day to 1972 production. The most significant of these fields was Raymond, with production found in four zones, the Nisku, Duperow, Winnepegosis, and Red River. Extensions of the Jim Coulee, and Sumatra fields in central Montana indicated separate new productive fields from the Tyler formation, which were expected to become important during 1973.

Natural gas produced in Montana during 1972 totaled 33.5 million cubic feet. This was a 2% decrease from 1971 output owing to greatly reduced production from the Cut Bank and Reagan fields in Glacier and Toole Counties. However, the Tiger Ridge gasfield went on-stream during November 1972, and in December production amounted to 1.9 million cubic feet, indicating total gas production in Montana during 1973 would show a substantial increase.

There were 753 wells drilled for oil and gas, a substantial increase over the 427 wells drilled in 1971. Exploratory drilling totaled 447 wells, of which 15 were oil discoveries, 29 were gas wells, and 403 were dry holes.

Development drilling totaled 306 holes, of which 68 were oil producers, 96 were gas producers, and 142 were dry holes. Exploratory and development drilling was most extensive in Blaine, Hill, Chouteau, and Glacier Counties where a combined total of 398 wells were drilled. The average well depth in the State was 3,131 feet.

More than 48 million barrels of oil were refined in Montana at nine oil refineries. The three largest refineries, which processed 89% of the total refined were Continental Oil Co. (17.2 million barrels), Exxon Corp. (15.4 million barrels), and Farmers Union Central Exchange, Inc. (10.6 million barrels).

Oil and gas exploration in Montana continued at a relatively high pace, much of the activity in areas with little or no previous production. The following Counties were reported to have areas staked for wildcatting: Big Horn, Carter, Custer, Rosebud, Powder River, Hill, Blaine, Chouteau, Fergus, Phillips, Valley, Big Hole, Glacier, Liberty, Toole, Dawson, Roosevelt, Gallatin, and Prairie. It was reported that programs for 50 or more wells had been launched for Hill, Blaine, Chouteau, and Fergus Counties. Deep discoveries in the eastern part of the State had helped to create the exploratory boom. To date, the exploration has brought in wildcats in different horizons, at varying depths, and in dissimilar zones.

Table 11.—Montana: Oil and gas well drilling completions in 1972, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Big Horn	--	--	--	--	--	5	5	26,449
Blaine	--	54	49	1	14	66	184	316,870
Carbon	--	--	--	--	1	5	6	27,209
Carter	1	--	--	--	--	11	12	35,623
Cascade	--	--	--	--	--	3	3	7,994
Chouteau	--	6	3	--	3	28	40	77,770
Custer	--	4	4	--	--	8	16	58,394
Daniels	--	--	--	--	--	1	1	7,410
Dawson	--	--	--	1	--	3	4	39,499
Fallon	1	--	--	--	--	5	6	29,295
Fergus	--	--	1	--	1	23	25	49,528
Garfield	--	--	--	--	--	3	3	19,423
Glacier	30	4	7	1	--	2	44	138,038
Golden Valley	--	--	--	--	--	5	5	14,455
Hill	--	18	35	--	8	69	130	222,891
Judith Basin	--	--	--	--	--	1	1	569
Liberty	--	--	3	--	--	26	29	91,590
McCone	3	--	7	--	--	15	25	156,051
Musselshell	12	--	11	3	--	15	41	171,334
Petroleum	--	--	2	--	--	1	3	5,463
Phillips	--	3	--	--	--	11	14	26,890
Pondera	5	--	--	--	--	9	14	41,330
Powder River	--	2	2	--	--	10	14	77,342
Richland	4	--	--	1	--	6	11	131,925
Roosevelt	2	--	3	1	--	6	12	109,730
Rosebud	4	--	3	3	--	16	26	121,563
Sheridan	3	--	4	2	--	11	20	175,543
Stillwater	--	--	1	--	--	1	2	7,297
Sweet Grass	--	--	--	--	--	1	1	5,485
Teton	--	--	--	--	--	4	4	9,348
Toole	2	3	7	2	--	15	29	67,117
Valley	--	2	--	--	2	11	15	60,115
Wheatland	--	--	--	--	--	1	1	5,028
Wibaux	1	--	--	--	--	--	1	7,900
Yelolwstone	--	--	--	--	--	6	6	15,556
Total	68	96	142	15	29	403	753	2,357,974

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 12.—Principal producers

Commodity and company	Address	Type of activity	County
METALS			
Aluminum: Anaconda Aluminum Co.	Columbia Falls, Mont. 59912	Reduction plant	Flathead.
	Great Falls, Mont. 59401	Rolling mill	Cascade.
Copper: The Anaconda Company.	Anaconda, Mont. 59711	Smelter	Deer Lodge.
	Butte, Mont. 59701	Mine, concentrator, precipitating plant.	Silver Bow.
	Great Falls, Mont. 59401	Refinery, rolling mill.	Cascade.
Gold: The Anaconda Company.	Anaconda, Mont. 59711	Smelter	Deer Lodge.
	Butte, Mont. 59701	Mine, concentrator, precipitating plant.	Silver Bow.
	Great Falls, Mont. 59401	Refinery, rolling mill.	Cascade.
Iron ore: R & S Iron Co	Radersburg, Mont. 59641	do	Broadwater.
Silver: The Anaconda Company.	Anaconda, Mont. 59711	Smelter	Deer Lodge.
	Butte, Mont. 59701	Mine, concentrator, precipitating plant.	Silver Bow.
	Great Falls, Mont. 59401	Refinery, rolling mill.	Cascade.
Tungsten: Minerals Engineering Co.	Glen, Mont. 59732	Mine and mill	Beaverhead.
NONMETALS			
Cement:			
Ideal Cement Co	420 Ideal Cement Bldg. Denver, Colo. 80202	Plant	Gallatin.
Kaiser Cement & Gypsum Corp.	300 Lakeside Dr. Oakland, Calif. 94604	do	Jefferson.
Clays:			
American Colloid Co	5100 Suffield Ct. Skokie, Ill. 60076	Pit	Carbon.
Hallett Minerals Co	P.O. Box 491 Forsyth, Mont. 59327	do	Rosebud and Treasure.
Ideal Cement Co., a division of Basic Industries Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Pit and plant	Gallatin.
International Minerals and Chemicals Corp. Industries.	Old Orchard Rd. Skokie, Ill. 60076	Pit	Carter.
Kanta Products, Inc	P.O. Box 96 Three Forks, Mont. 59752	Pit and plant	Gallatin.
Kaiser Cement & Gypsum Corp.	Permanente Rd. Permanente, Calif. 95014	do	Jefferson.
Lewistown Brick & Tile Co.	P.O. Box 573 Lewistown, Mont. 59457	do	Fergus.
Lovell Clay Products Co	1312 Lockwood Rd. Billings, Mont. 59101	do	Yellowstone.
Baroid Div., NL Industries, Inc.	P.O. Box 1675 Houston, Tex. 77001	Pit	Carter.
Treasurelite, a division of Treasure State Industries, Inc.	P.O. Box 2750 Great Falls, Mont. 59401	do	Cascade.
Fluorspar: Roberts Mining Co.	P.O. Box 365 Darby, Mont. 59829	Mine and plant	Ravalli.
Gypsum: U.S. Gypsum Co	Lewiston, Mont. 59457	Underground mine and calcining plant.	Fergus.
Lime: The Anaconda Company.	Anaconda, Mont. 59711	Plant	Deer Lodge.
Great Western Sugar Co	Box 5308 Denver, Colo. 80217	do	Yellowstone.
Holly Sugar Corp	Box 1052 Colorado Springs, Colo. 80901	do	Richland.
Phosphate rock:			
Cominco American, Inc	Garrison, Mont. 59731	Mine and plant	Powell.
Sauffer Chemical Co	299 Park Ave. New York, N.Y. 10017	Plant	Silver Bow.
Sand and gravel:			
Gallatin Sand and Gravel	Box 248 Bozeman, Mont. 59715	Pit	Gallatin.
R. A. Heintz Construction Co.	Box 11005 Portland, Oreg.	do	Lincoln.
McElroy & Wilkin Inc	P.O. Box 35 Kalispell, Mont. 59901	do	Flathead.
Midland Materials Co	Box 2521 Billings, Mont. 59103	do	Yellowstone.
Barry O'Leary	Box 1102 Billings, Mont. 59103	do	Do.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Pioneer Concrete & Fuel	843 Maryland Ave. Butte, Mont. 59701	do	Deer Lodge.
Pioneer Ready Mix	Box 818 Bozeman, Mont. 59715	do	Gallatin.
Redi Mix Concrete Co	Box 248 Polson, Mont. 59860	do	Lake.
Richardson Construction Co.	Box 449 Miles City, Mont. 59301	do	Various.
Tressler & Low Ready Mix.	Box 914 Helena, Mont. 59601	do	Lewis and Clark.
Stone:			
The Anaconda Company	Anaconda, Mont. 59711	Quarry and plant	Deer Lodge.
Grant Construction Co	Haypen Lake, Ind. 83835	do	Jefferson.
Ideal Cement Co.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Gallatin.
Kaiser Cement & Gypsum Corp.	Permanente Rd. Permanente, Calif. 95014	do	Jefferson.
Sulfur:			
Farmer's Union Central Exchange, Inc.	P.O. Box 126 Laurel, Mont. 59044	Plant	Yellowstone.
Montana Sulphur & Chemical Co.	P.O. Box 1084 Billings, Mont. 59103	do	Do.
Sulfuric acid: The Anaconda Company.	Anaconda, Mont. 59711	do	Deer Lodge.
Talc and soapstone: Pfizer, Inc.	Dillion, Mont. 59725	do Mine	Beaverhead. Madison.
Vermiculite: W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 01109	Pit and plant	Lincoln.
Exfoliated vermiculite: Robinson Insulation Co.	12th St. North and River Dr. Great Falls, Mont. 59401	Plant	Cascade.
MINERAL FUELS			
Coal:			
Divide Coal Mining Co	P.O. Box 342 Roundup, Mont. 59072	Mine	Musselshell.
Knife River Coal Mining Co.	Savage, Mont. 59262	do	Richland.
Peabody Coal Co	301 D. Memorial Dr. St. Louis, Mo. 63102	do	Rosebud.
P & M Coal Mine	1600 Tenmain Center Kansas City, Mo. 64105	do	Musselshell.
Western Energy Co	40 East Broadway Butte, Mont. 59701	do	Rosebud.
Peat: Martin's Peat & Potting Soils.	Swan Lake, Mont. 59872	Bog	Lake.
Big West Oil Co. of Montana.	Kevin, Mont. 59454	Refinery	Toole.
Continental Oil Co	Billings, Mont. 59101	do	Yellowstone.
Diamond Asphalt Co	Chinook, Mont. 59523	do	Blaine.
Exxon Corp., U.S.A	Laurel, Mont. 59044	do	Do.
Farmer's Union Central Exchange, Inc.	Mosby, Mont. 59058	do	Yellowstone.
Jet Fuel Refinery	Billings, Mont. 59101	do	Garfield.
Phillips Petroleum Co	Great Falls, Mont. 59401	do	Cascdae.
Spruce Oil Corp	Wolf Point, Mont. 59201	do	Roosevelt.
Westco Refining Co	Box 818 Cut Bank, Mont. 59427	do	Glacier.

The Mineral Industry of Nebraska

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Conservation and Survey Division of the University of Nebraska, Nebraska Geological Survey, for collecting information on all minerals except fuels.

By Ted C. Briggs [1] and Raymond R. Burchett [2]

Nebraska's total mineral production, valued at $73,675,000 in 1972, was about 0.5% less than that of 1971. A 13% decline in the value of crude petroleum produced and a 3% decline in the value of stone produced were largely offset by increases in value of the other minerals produced in the State.

The Nebraska Geological Survey completed a new geologic map of 14 southeastern counties. The map was prepared for a better understanding of the configuration of the bedrock and to aid in locating mineral deposits.[3]

A small steel mill was under construction near Norfold for Nuclear Corp. of America. The mill, when completed, will melt scrap steel to produce 160,000 tons per year of bar stock. The mill is expected to employ about 200 persons and have an annual payroll of about $2 million. The mill is expected to purchase annually about $5 million worth of scrap steel, $400,000 worth of natural gas, $300,000 worth of graphite electrodes, and $1 million worth of electricity.[4]

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[1] Chemist, Division of Nonmetallic Minerals—Mineral Supply.

[2] Research geologist, Nebraska Geological Survey.

[3] Burchett, R. R., V. H. Dreeszen, E. C. Reed, and G. E. Prichard. Bedrock Geologic Map Showing Thickness of Overlying Quaternary Deposits, Lincoln Quadrangle and Part of Nebraska City Quadrangle, Nebraska and Kansas. Nebr. Geol. Survey (in cooperation with the U.S. Geological Survey).

[4] Omaha World-Herald. Cold Can't Delay "Mini-Steel Mill." V. 108, No. 72, Dec. 11, 1972, p. 17.

Table 1.—Mineral production in Nebraska [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays .... thousand short tons	69	$82	115	$143
Gem stones	NA	10	NA	11
Lime .... thousand short tons	29	W	34	685
Natural gas (marketed) .... million cubic feet	3,496	612	3,478	619
Petroleum (crude) .... thousand 42-gallon barrels	10,062	34,010	8,705	29,423
Sand and gravel .... thousand short tons	13,224	13,626	13,720	15,063
Stone .... do	4,174	7,892	4,251	7,645
Value of items that cannot be disclosed: Cement, natural gas liquids, pumice, and values indicated by symbol W	XX	17,847	XX	20,086
Total	XX	74,079	XX	73,675
Total 1967 constant dollars	XX	63,005	XX	[p] 61,290

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

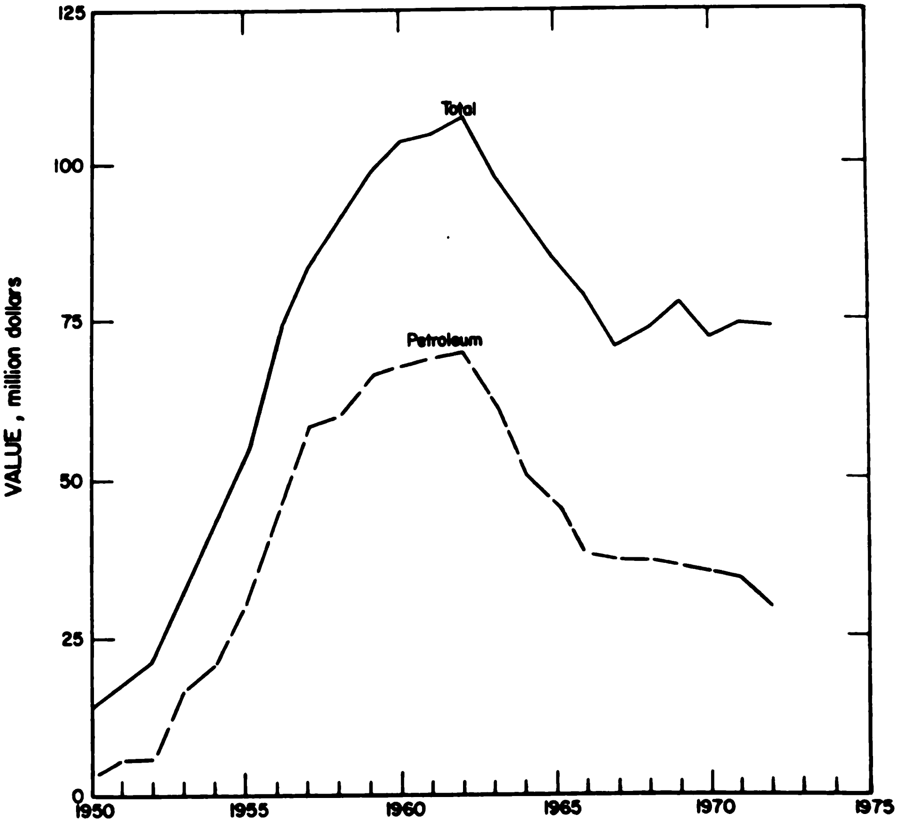

Figure 1.—Value of petroleum and total value of mineral production in Nebraska.

Table 2.—Value of mineral production in Nebraska, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	W	W	Sand and gravel.
Antelope	$121	$105	Do.
Arthur		W	Do.
Banner	3,853	3,594	Petroleum, natural gas, sand and gravel.
Blaine	8	--	
Boone		W	Sand and gravel.
Brown	W	W	Do.
Buffalo	508	297	Do.
Burt		W	Do.
Butler	W	W	Do.
Cass	16,279	20,122	Cement, stone, sand and gravel, clays.
Cedar	223	192	Sand and gravel.
Chase	3	2	Do.
Cherry	--	W	Do.
Cheyenne	W	7,322	Petroleum, natural gas liquids, sand and gravel.
Clay	61	204	Sand and gravel.
Colfax	81	105	Do.
Cuming	618	W	Do.
Custer	90	W	Sand and gravel, pumice.
Dakota	9	--	
Dawson	369	368	Sand and gravel.
Deuel	W	W	Natural gas, sand and gravel.
Dixon	W	W	Sand and gravel, stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Nebraska, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Dodge	$428	W	Sand and gravel.
Douglas	W	$2,897	Sand and gravel, clays.
Dundy	10	W	Petroleum, sand and gravel.
Franklin	76	55	Sand and gravel.
Frontier	247	W	Petroleum, sand and gravel, natural gas.
Furnas	W	37	Sand and gravel, petroleum.
Gage	W	W	Sand and gravel, stone.
Garden	40	W	Petroleum, sand and gravel.
Hall	224	270	Sand and gravel.
Hamilton	2	W	Do.
Harlan	W	W	Petroleum, sand and gravel.
Hayes	W	W	Sand and gravel.
Hitchcock	W	W	Petroleum, sand and gravel.
Holt	399	163	Sand and gravel.
Howard	W	W	Do.
Jefferson	W	W	Sand and gravel, clays.
Johnson	W	W	Stone.
Kearney	28	35	Sand and gravel.
Keith	97	W	Do.
Keya Paha	2	3	Do.
Kimball	7,560	6,361	Petroleum, natural gas liquids, sand and gravel.
Knox	155	140	Sand and gravel.
Lancaster	255	115	Stone, clays, sand and gravel.
Lincoln	W	39	Sand and gravel, petroleum.
Loup	35	--	
McPherson	W	W	Sand and gravel.
Madison	W	W	Do.
Merrick	W	W	Do.
Morrill	W	1,722	Petroleum, sand and gravel, lime, natural gas.
Nance	W	W	Sand and gravel.
Nemaha	W	W	Stone.
Nuckolls	W	W	Cement, stone.
Otoe	W	W	Stone, lime, clays.
Pawnee	W	W	Stone.
Perkins	9	W	Sand and gravel.
Phelps	W	W	Do.
Pierce	75	144	Do.
Platte	W	1,012	Do.
Polk	W	W	Do.
Red Willow	12,678	10,175	Petroleum, sand and gravel.
Richardson	234	W	Petroleum, stone.
Rock	1	1	Sand and gravel.
Saline	166	107	Do.
Sarpy	W	W	Sand and gravel, stone, clays.
Saunders	W	1,395	Sand and gravel.
Scotts Bluff	W	W	Petroleum, lime, sand and gravel.
Seward	W	W	Stone, natural gas.
Sheridan	--	221	Sand and gravel.
Stanton	W	W	Do.
Thayer	W	W	Sand and gravel, stone.
Thomas	W	W	Sand and gravel.
Valley	W	W	Do.
Washington	W	W	Stone.
Webster	14	156	Sand and gravel.
Wheeler	W	W	Do.
York	W	169	Do.
Undistributed [2]	29,119	16,147	
Total	[3] 74,079	78,675	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Box Butte, Boyd, Dawes, Fillmore, Garfield, Gosper, Grant, Greeley, Hooker, Logan, Sherman, Sioux, Thurston, and Wayne.

[2] Includes gem stones, some sand and gravel, and some stone (1971) which cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data do not add to total shown because of independent rounding.

Tentative plans to sell the mineral rights to the former Sioux Army Depot Reservation in Cheyenne County were disclosed by the Federal Government. Minerals under the 30,000-acre reservation were declared surplus by the General Services Administration and will be sold to the highest bidder.[5]

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[5] Engineering and Mining Journal. Nebraska. V. 174, No. 3, March 1973, pp. 197–198.

Table 3.—Indicators of Nebraska business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ... thousands	685.3	712.5	+4.0
Unemployment ... do	23.0	21.9	−4.8
Employment ... do	662.3	690.6	+4.3
Mining ... do	1.6	1.6	--
Construction ... do	23.9	27.7	+15.9
Manufacturing ... do	83.0	86.6	+4.3
Government ... do	105.3	108.6	+3.1
Other nonagricultural employment ... do	274.9	288.2	+4.8
Personal income:			
Total ... millions	$6,077	$6,621	+9.0
Per capita	$4,030	$4,341	+7.7
Construction activity:			
Value of nonresidential construction ... millions	$65.4	$87.2	+33.3
Number of new housing units	13,156	13,010	−1.1
Cement shipments to and within the State ... thousand short tons	850	969	+14.0
Mineral production value ... millions	$74.1	$73.7	−0.5

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	2	10	(1)	(1)	--	--	--	--
Nonmetal	15	205	3	23	--	--	--	--
Sand and gravel	880	209	184	1,715	--	31	18.08	996
Stone	531	296	157	1,344	--	34	25.30	2,631
Total	1,428	241	344	3,082	--	65	21.09	1,701
1972: [2]								
Metal	--	--	--	--	--	--	--	--
Nonmetal	25	177	4	38	--	1	26.60	80
Sand and gravel	670	209	140	1,320	1	17	13.64	4,899
Stone	480	314	151	1,249	2	16	14.41	9,879
Total	1,175	251	295	2,607	3	34	14.19	7,216

[1] Less than 500.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Ash Grove Cement Co. planned to replace five old wet-process kilns built in 1929 with a new dry-process kiln. When completed, in late 1974 or early 1975, the annual capacity will be increased by 282,000 tons to a total of 936,000 tons. Apparent consumption of portland cement in the State totaled 955,937 tons, and apparent consumption of masonry cement in the State totaled 13,344 tons. Raw materials used in making portland cement included limestone and cement rock, gypsum, and sandstone materials. Disposition of portland cement by type of customer in 1972 was 62% to ready-mix concrete companies, 11% to concrete product manufacturers, 4% to building materials dealers, and 23% to contractors and other users.

Clays.—Five firms produced clay in 1972. The quantity of clay produced in 1972 increased substantially, 67% over the quantity produced in 1971. The value of clay produced increased 74% over the 1971 value.

Endicott Clay Products Co., near Endicott in Jefferson County, produced clay to make face bricks. Omaha Brick Works, near Ralston in Douglas County, produced clay to make face and common brick. Yankee Hill Brick Manufacturing Co., near Lincoln in Lancaster County, produced clay to make face brick. Western Brick & Aggregate Co., near Nebraska City in Otoe County, produced clay to make lightweight aggregate. Ash Grove Cement Co., near Louisville in Cass County, produced clay to make portland and other cement.

Fertilizer Materials.—Of the three major crop nutrients, only nitrogen was produced in the State. Allied Chemical Corp. has an anhydrous ammonia plant with a capacity of 202,000 tons per year at La Platte; C F Industries, Inc., has an ammonia plant with a capacity of 48,000 tons per year at Fremont; Farmland Industries, Inc., has an ammonia plant with a capacity of 140,000 tons per year at Hastings; and Phillips Petroleum Co. has an ammonia plant with a capacity of 210,000 tons per year at Beatrice. Total ammonia capacity in the State was about 600,000 tons per year in 1972.

The following nitrogenous fertilizer materials were consumed in the State during the fiscal year ending June 30, 1972: 459,491 tons of anhydrous ammonia, 6,807 tons of aqua ammonia, 134,957 tons of ammonium nitrate, 4,822 tons of ammonium sulfate, 237,785 tons of nitrogen solutions, and 15,305 tons of urea. Total consumption of agricultural nitrogen, from mixtures and direct application materials, was 550,322 tons in fiscal 1972, an increase of 3% over fiscal 1971 consumption.

According to the Potash Institute of North America, shipments of domestic and imported potash into Nebraska in 1972 were 38,573 tons of K_2O equivalent for agricultural purposes and 501 tons of K_2O equivalent for nonagricultural purposes. Of the agricultural potash, 10% was in the form of standard-grade potassium chloride, 27% as coarse-grade potassium chloride, 37% as granular-grade potassium chloride, 11% as soluble-grade potassium chloride, and 15% as potassium magnesium sulfate. All of the nonagricultural potash was in the form of potassium chloride, 70% as soluble-grade potassium chloride.[6]

Consumption of phosphatic fertilizers decreased from 150,288 tons P_2O_5 equivalent in fiscal 1971 to 149,293 tons P_2O_5 equivalent in fiscal 1972, a decline of less than 1%. About 32% of the available P_2O_5 equivalent was applied as ammonium phosphate containing 18% nitrogen and 46% P_2O_5 equivalent.[7]

Most of the fertilizer materials consumed in the State were used to produce corn, soybeans, and wheat. For fiscal year 1972, 5.1 million acres of corn were harvested, and of the acreage fertilized, about 93%, some 139 pounds of nitrogen, 40 pounds of P_2O_5 equivalent, and 18 pounds of K_2O equivalent were applied per acre. About 740,000 acres of soybeans were harvested, and of the acreage fertilized, about 22%, approximately 14 pounds of nitrogen, 34 pounds of P_2O_5 equivalent, and 22 pounds of K_2O equivalent were applied per acre. About 2.6 million acres of wheat were harvested, and of the acreage fertilized, about 46%, about 40 pounds of nitrogen, 44 pounds of P_2O_5 equivalent, and 6 pounds of K_2O equivalent were applied per acre.[8]

Lime.—Great Western Sugar Co. produced lime in plants near Bayard in Morrill County and near Scottsbluff, Gering, and Mitchell in Scotts Bluff County. Western aggregates produced lime near Nebraska City in Otoe County. Lime production, sold or used, in 1972 was 34,142 tons, compared with 28,987 tons in 1971, an increase of 18%.

Perlite.—W. R. Grace & Co., Zonolite Div., produced expanded perlite near Omaha from out-of-State crude perlite. Major uses were as aggregate for plaster, horticulture, and concrete.

Pumice.—LaRue Axtell Pumice Co. produced pumice at its LeMaster strip mine near Arnold, Custer County. The pumice was used to produce cleaning and scouring compounds and hand soaps.

Sand and Gravel.—Nebraska produced 4% more sand and gravel in 1972 than in 1971. The average value of sand and gravel in 1972 was $1.10 per ton compared with $1.03 in 1971.

Leading producers were Lyman-Richey Sand & Gravel Corp. in Cass, Dodge, Douglas, Morrill, Platte, Sarpy, and Saunders Counties; Hartford Sand & Gravel Co. in Douglas County; Central Sand & Gravel Co. in Butler, Madison, and Platte Counties; Western Sand & Gravel Co. in Cass and Saunders Counties; and Luther Sand & Gravel Co. in Buffalo County.

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[6] Potash Institute of North America (Atlanta, Ga.). Deliveries of Agricultural and Non-agricultural Potash Salts (K_2O). Press Release E-218, February 1973, 12 pp.

[7] U.S. Department of Agriculture. Commercial Fertilizers. Consumption in the United States. Year Ended June 30, 1972. Statistical Reporting Service No. SpC27, May 1973, 26 pp.

[8] U.S. Department of Agriculture. 1973 Fertilizer Situation. Econ. Res. Service No. FS-3, December 1972, 37 pp.

Of the 5.2 million tons of sand sold or used in 1972 at commercial operations, 70% was used in building, 11% for fill, 19% in paving, and the balance in other uses. Of the 7.2 million tons of gravel sold or used at commercial operations, 72% was used in paving, 16% in building, and the balance in miscellaneous and other uses.

Stone.—Limestone was the only stone produced in Nebraska. Dimension and crushed and broken limestone was produced at 24 operations in 14 of the State's 93 counties. The quantity of limestone sold or used in 1972 was 2% above the quantity sold or used in 1971. The average value of limestone was $1.80 in 1972, com-

Table 5.—Nebraska: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Antelope	5	131	121	4	113	105
Arthur	--	--	--	1	W	W
Banner	1	39	29	1	W	W
Blaine	1	7	8	--	--	--
Buffalo	14	645	508	8	413	297
Cedar	5	188	223	6	171	192
Chase	1	14	3	1	W	2
Cheyenne	2	W	W	1	W	79
Clay	1	85	61	3	215	204
Colfax	4	111	81	3	109	105
Cuming	7	552	618	3	W	W
Custer	4	100	90	4	176	143
Dakota	1	13	9	--	--	--
Dawson	11	455	369	5	433	368
Deuel	2	40	35	2	W	W
Dodge	9	357	428	8	W	W
Douglas	9	2,399	2,558	11	2,586	2,893
Dundy	1	4	3	1	W	W
Franklin	5	92	76	3	54	55
Furnas	--	W	W	3	29	27
Garden	3	38	10	2	W	W
Hall	7	312	224	5	316	270
Hamilton	1	53	2	2	W	W
Holt	10	331	399	7	255	163
Jefferson	6	W	W	5	302	W
Johnson	1	2	7	--	--	--
Kearney	1	59	28	1	48	35
Keith	8	154	97	3	W	W
Keya Paha	2	2	2	1	27	3
Kimball	2	36	8	1	32	4
Knox	11	160	155	4	118	140
Lincoln	4	W	W	3	59	36
Loup	3	41	35	--	--	--
Nuckolls	1	W	32	--	--	--
Perkins	2	23	9	1	W	W
Phelps	2	149	W	1	160	W
Pierce	3	W	75	4	111	144
Platte	6	711	W	4	672	1,012
Red Willow	5	121	148	7	135	130
Rock	1	1	1	1	1	1
Saline	5	142	166	3	85	107
Sarpy	7	500	467	8	614	W
Saunders	9	1,273	1,298	4	1,243	1,395
Scotts Bluff	4	228	209	4	218	185
Sheridan	--	--	--	1	W	221
Thayer	1	W	W	3	W	203
Webster	1	18	14	4	178	156
York	5	W	W	3	149	169
Undistributed [1]	[r] 74	3,687	5,023	47	4,699	6,220
Total [2]	268	13,224	13,626	197	13,720	15,063

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Adams, Arthur (1972), Boone (1972), Brown, Burt (1972), Butler, Cass, Cherry (1972), Dixon, Frontier, Gage, Harlan, Hayes, Hitchcock, Howard, Lancaster, McPherson, Madison, Merrick, Morrill, Nance, Polk, Stanton, Thomas, Valley, Wheeler Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

pared with $1.89 in 1971. The largest uses, in descending order, were concrete aggregate, cement, road base, riprap, and agricultural lime. Leading producers were Hopper Bros. Quarries, Ash Grove Cement Co., Fort Calhoun Stone Co., and Kerford Limestone Co.

Talc.—The United Sierra Division of Cyprus Mines Corp. ground talc at its plant near Grand Island. The talc came from company mines in Montana and California and from another firm in California. The material was prepared for export and for use in making paper, ceramics, paint, textiles, rubber, and toilet powders.

Vermiculite.—W. R. Grace & Co., Zonolite Div., produced exfoliated vermiculite near Omaha from crude vermiculite ob-

Table 6.—Nebraska: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,705	2,543	3,599	3,482
Fill	494	427	568	407
Paving	1,788	2,058	965	1,165
Other uses [1]	40	34	21	24
Total [2]	5,027	5,062	5,152	5,078
Gravel:				
Building	995	1,043	1,122	1,315
Fill	162	138	W	W
Paving	5,862	6,462	5,172	6,142
Miscellaneous	W	W	447	382
Other uses [3]	528	514	423	458
Total [2]	7,548	8,156	7,164	8,298
Government-and-contractor operations:				
Sand: Paving	75	30	269	308
Total	75	30	269	308
Gravel:				
Building	36	4	78	8
Paving	447	243	717	823
Other uses	90	131	339	549
Total [2]	573	377	1,134	1,380
Total sand and gravel [2]	13,224	13,626	13,720	15,068

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes other (1972) and unground sand.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1972), fill (1972), miscellaneous (1971) and other gravel.

Table 7.—Nebraska: Limestone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone total	6	75	(1)	3
Crushed and broken stone:				
Dense graded road base stone	1,536	2,934	346	569
Surface treatment aggregate	248	555	238	532
Agricultural lime	119	225	318	W
Poultry grit and mineral food	W	W	59	W
Other uses [2]	2,265	4,102	3,289	6,542
Crushed total [3]	4,168	7,817	4,251	7,642
Grand total [3]	4,174	7,892	4,251	7,645

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Less than ½ unit.

[2] Includes stone used in asphalt filler, bituminous aggregate, concrete aggregate, cement, and riprap and jetty stone. The 1971 data also include stone used in whiting, dam construction, and unspecified construction aggregate.

[3] Data may not add to totals shown because of independent rounding.

tained from Libby, Mont. The quantity sold in 1972 was slightly more than that in 1971. The material was used principally in loose fill insulation, concrete and plaster aggregate, and horticulture.

MINERAL FUELS

Natural Gas.—A total of 3,478 million cubic feet[9] of natural gas was marketed in 1972 compared with 3,496 million cubic feet in 1971, a decline of less than 1%.

At yearend, the estimated reserves of natural gas in Nebraska were 50 billion cubic feet compared with a national total, including offshore gas, of 266 trillion cubic feet. The estimated gas reserves in Nebraska consisted of 17 billion cubic feet of nonassociated gas, 8 billion cubic feet of associated and dissolved gas, and the balance in underground storage. Nebraska's natural gas reserves were among the smallest of the domestic reserves. At yearend, there were 29 active and seven capped gas wells.

Table 8.—Nebraska: Oil and gas well drilling completions, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Antelope	--	--	--	--	--	2	2	7,263
Banner	3	--	2	--	--	25	30	180,093
Box Butte	--	--	--	--	--	3	3	10,173
Cheyenne	8	2	31	3	--	43	87	439,298
Dawes	--	--	--	--	--	1	1	5,000
Dawson	--	--	--	--	--	1	1	3,637
Deuel	--	--	--	--	--	1	1	3,605
Frontier	--	--	--	--	--	4	4	15,374
Garden	--	--	--	--	--	6	6	21,787
Gosper	--	--	--	--	--	1	1	3,346
Hayes	--	--	--	--	--	3	3	14,313
Hitchcock	--	--	--	--	--	1	1	4,150
Keya Paha	--	--	--	--	--	1	1	1,350
Kimball	2	--	11	2	--	22	37	238,803
Lincoln	--	--	--	--	--	29	29	116,497
Morrill	3	--	4	3	--	19	29	129,630
Nemaha	--	--	--	--	--	2	2	5,991
Phelps	--	--	--	--	--	1	1	2,278
Red Willow	19	--	2	--	--	7	28	98,527
Richardson	1	--	1	1	--	2	5	12,217
Scotts Bluff	2	--	3	1	--	7	13	67,228
Sheridan	--	--	--	--	--	2	2	3,964
Sioux	--	--	--	--	--	5	5	23,144
Total	88	2	54	10	--	188	292	1,407,668

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Natural Gas Liquids.—Production and value of liquid petroleum gases, and natural gasoline and cycle products decreased 15% and 14%, respectively.

Petroleum.—A total of 8.7 million barrels of petroleum was produced in 1972 compared with 10.1 million barrels produced in 1971, a 13% decline.

At yearend, the estimated reserves of crude oil in Nebraska were 31 million, 42-gallon barrels compared with a national total of 36 billion barrels. Nebraska's oil reserves ranked 23d of the 31 States with oil. At yearend, there were 1,114 active oil wells in the State and 645 capped oil wells, compared with 1,191 active oil wells and 557 capped oil wells at yearend 1971.

Table 9.—Nebraska: Number of active and capped oil and dry gas wells at yearend 1972

County	Oil wells		Dry gas wells	
	Active	Capped	Active	Capped
Banner	177	116	--	--
Cheyenne	222	65	18	3
Deuel	--	--	10	4
Dundy	--	1	--	--
Frontier	8	8	--	--
Furnas	--	8	--	--
Garden	2	--	--	--
Harlan	8	1	--	--
Hitchcock	80	18	--	--
Kimball	278	234	1	--
Lincoln	--	8	--	--
Morrill	68	82	--	--
Red Willow	280	147	--	--
Richardson	16	20	--	--
Scotts Bluff	80	7	--	--
Total	1,114	645	29	7

Source: Nebraska Oil and Gas Conservation Commission.

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[9] 14.73 psia, at 60°F.

Table 10.—Nebraska: Crude petroleum production by county
(Thousand 42-gallon barrels)

County	1971	1972	Principal fields
Banner	1,125	1,056	Singleton, Johnson, Harrisburg, Willson Ranch.
Cheyenne	1,859	1,854	Southwest Sidney, Graff, Southwest Potter, Doran, West Engelland.
Dundy	2	1	East Indian Creek, Rock Canyon.
Frontier	73	63	Bed Canyon.[1]
Furnas	5	3	Southwest Wilsonville.
Garden	9	9	Richards and McCord.
Harlan	40	23	South Alma.
Hitchcock	159	131	Reiher.
Kimball	1,979	1,688	Sloss, Enders, Bertramson, Axial, Houtby, Fernquist, Jacinto.
Lincoln	5	1	Red Willow Creek.
Morrill	499	436	Bridgeport.
Red Willow	3,707	2,972	Sleepy Hollow, Ackman, Silver Creek, Northwest Sleepy Hollow, Bed Canyon.[1]
Richardson	50	48	Dawson, Falls City, Barada.
Scotts Bluff	550	420	Cedar Valley, Minatare.
Total	10,062	8,705	

[1] Partly in Frontier and Red Willow Counties.

Source: Production figures from Nebraska Oil and Gas Conservation Commission.

Table 11.—Nebraska: Crude oil production in the 25 largest fields in 1972
(42-gallon barrels)

Field	County	Annual output	Average daily output
Sleepy Hollow	Red Willow	2,237,599	6,114
Jormar	Cheyenne	248,818	680
Ackman	Red Willow	226,263	618
Cedar Valley	Scotts Bluff	221,235	604
Margate	Cheyenne	205,869	562
Silver Creek	Red Willow	205,447	561
Southwest Sidney	Cheyenne	180,639	494
Singleton	Banner	155,514	425
Bridgeport	Morrill	144,476	395
Sloss	Kimball	124,305	340
Enders	do	100,244	274
Johnson	Banner	88,381	241
Reiher	Hitchcock	83,522	228
Stage Hill	Banner and Scotts Bluff	81,048	221
Bertramson	Kimball	80,426	220
Minatare	Scotts Bluff	74,710	204
Bed Canyon	Frontier and Red Willow	73,136	200
West Engelland	Cheyenne	71,187	195
Axial	Kimball	70,873	194
Danbury	Red Willow	69,166	189
Stauffer	Banner	69,031	188
Simpson	Kimball	67,928	186
Southwest Potter	Cheyenne	65,906	180
Raymond	Banner	64,268	176
Filon	Cheyenne	63,911	175

Source: Nebraska Oil and Gas Conservation Commission.

METALS

No metallic minerals were mined in Nebraska, but antimony, bismuth, gold, lead, and silver were recovered from out-of-State lead bullion and other smelter products by American Smelting and Refining Co. at its Omaha refinery.

Table 12.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Ash Grove Cement Co.	1000 Tenmain Center Kansas City, Mo. 64105	Wet process, 6-rotary-kiln plant.	Cass.
Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Wet process, 2-rotary-kiln plant.	Nuckolls.
Clays:			
Ash Grove Cement Co.	1000 Tenmain Center Kansas City, Mo. 64105	Open pit mine and plant.	Cass.
Endicott Clay Products Co	Endicott, Nebr. 68350	do	Jefferson.
Western Brick & Aggregate Co.	Box 1141 Nebraska City, Nebr. 68410	do	Otoe.
Yankee Hill Brick Manufacturing Co.	Route 1 Lincoln, Nebr. 68502	do	Lancaster.
Lime: Great Western Sugar Co., a subsidiary of Great Western United Corp.	Box 5308 Denver, Colo. 80217	Pot kiln at beet-sugar plant.	Morrill.
		5 pot kilns at beet-sugar plants.	Scotts Bluff.
Natural gas and petroleum [1]			
Pumice: LaRue Axtell Pumice Co.	Callaway, Nebr. 68825	Open pit mine and plant.	Lincoln.
Sand and gravel (commercial):			
Central Sand & Gravel Co.	Box 626 Columbus, Nebr. 68601	Dredging operation	Butler.
		do	Hall.
		do	Pierce.
		2 dredging operations	Madison.
		3 dredging operations	Platte.
Consolidated Sand and Gravel Corp.	712 D St. Fairbury, Nebr. 68352	Pit and plant	Jefferson.
Hank Stalp Gravel Co.	Box 6 West Point, Nebr. 68788	3 dredging operations	Cuming.
Hartford Sand & Gravel Co	Box 571 Valley, Nebr. 68064	2 dredging operations	Douglas.
		4 pits	Dodge.
Lyman-Richey Sand & Gravel Corp.	4315 Cuming St. Omaha, Nebr. 68131	Pit and plant	Cass.
		2 pits and plants	Dodge.
		do	Douglas.
		Pit and plant	Morrill.
		do	Platte.
		2 pits and plants	Sarpy.
		Pit and plant	Saunders.
McCann Sand & Gravel Co.	Valley, Nebr. 68064	2 dredging operations	Douglas.
Overland Sand & Gravel Co.	22 Main St. Stromberg, Nebr. 68666	4 dredging operations	Merrick.
		Dredging operation	Nance.
		do	Polk.
Western Sand & Gravel Co	Box 268 Lincoln, Nebr. 68501	do	Cass.
		3 dredging operations	Saunders.
Carl W. Whitney	1402 Ninth Ave. Kearney, Nebr. 68847	Pit and plant	Buffalo.
Wolf Sand and Gravel Co.	Morse Bluff, Nebr. 68648	Pits and plants	Saunders.
Stone:			
Ash Grove Cement Co.	1000 Tenmain Center Kansas City, Mo. 64105	Quarry and plant	Cass.
Behrens Construction Co.	P.O. Box 188 Beatrice, Nebr. 68310	do	Gage.
Fort Calhoun Stone Co.	1255 South St. Blair, Nebr. 68008	do	Thurston.
		do	Washington.
Hopper Bros. Quarries	Weeping Water, Nebr 68463	3 quarries and plant	Cass.
		Quarry and plant	Nemaha.
		do	Pawnee.
		do	Saunders.
Kerford Limestone Co.	Box 434 Weeping Water, Nebr. 68463	do	Cass.
United Rock Construction, Inc.	1117 Woodman of the World Bldg. Omaha, Nebr. 68102	do	Do.

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[1] Most of the major oil and gas companies and many smaller companies operate in Nebraska, and several commercial directories contain complete lists of them.

The Mineral Industry of Nevada

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, United States Department of the Interior, and the Nevada Bureau of Mines for collecting information on all minerals.

By V. Anthony Cammarota, Jr.[1]

Aided primarily by increased production of barite, copper, gold, and lithium minerals, the value of Nevada's mineral output recovered to $181.7 million compared with $164.8 million in 1971. Production value of metals as a group increased 9.3%, nonmetals increased 13%, and mineral fuels (petroleum) decreased 11%.

With the value of gold production increasing 59% in 1972 compared with that of 1971, the State became the Nation's leading gold producer. Copper production was up 4%, but its portion of the total value of the State's mineral production slipped from 61% in 1971 to 57% in 1972. Mercury production declined substantially because almost every mercury mine in the State ceased operations. No zinc and essentially no lead were produced.

Of the 18 nonmetallic materials, 11 showed increases in production, five showed decreases, and two were unchanged. The largest percentage gains were made by barite, gypsum, lithium minerals, pumice, and stone, while fluorspar and perlite showed the largest declines. Talc production was reported after a 1-year cessation, but no brucite or pyrites was produced in 1972.

The Nevada Environmental Protection Commission approved Kennecott's plan to cut sulfur dioxide emissions 60% by 1975. However, the Federal Environmental Protection Agency whose standard requires 90% reduction, has not approved the State plan. A company spokesman said that to meet the 60% reduction will require a reduction in work force and $20 million in expenses at its 60-year-old plant at McGill. Kennecott completed the installation of a new converter, the smelter's fourth, in order to assure continuous operation in case of a converter breakdown. Baghouses were installed at the crusher site to collect dust from which mineral values will be extracted.

Trends and Developments.—The Smelter Control Research Association, Inc., focused on a program to investigate sulfur dioxide removal from low-strength gas streams, such as those from reverberatory furnaces, containing about 0.5 to 1% sulfur dioxide. Because of the time factor in achieving the control required by the States at major smelting operations, first attention was given to control systems that are nearest to commercial availability and that can be added on to existing smelter operations. The pilot plant is located at Nevada Mines Division, Kennecott Copper Corp., near McGill.

Cliffs Copper Corp. completed dewatering the Rio Tinto mine near Mountain City, Elko County, and prepared drilling stations on the fourth level. The company plans to blast the ore deposit for an in situ copper leaching operation. Calta Mines Ltd. of Vancouver, British Columbia, Canada, which acquired some property near Contact in northern Elko County, reported an estimated ore reserve of 8.1 million tons averaging 2.3% copper, silver, and molybdenum. The drilling program continued with two rigs operating. Later in the year, Phelps Dodge Corp. entered into an exploration and mining contract with Calta on the property.

At Tybo, Silver King Mines, Inc., and Pacific Silver Corp. continued their rehabilitation work on the Hales shaft. The company encountered water below the 400-foot level, which will slow up their process of retimbering the shaft. The Sunshine Mining Co. entered into an agreement with Quantex Corp. for the exploration and development of the Silver Star mine in Elko County. Drill-hole intersections showed 20- to 60-foot vein widths assaying about 22 ounces of silver per ton. If adequate ore reserves are confirmed, the company plans to construct a mill.

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[1] Physical scientist, Division of Nonferrous Metals.

The Goldfield Corp. announced that an option on approximately 20,700 acres of its Getchell gold mining property, Humboldt County, has been granted to the Continental Oil Co. Continental is required under the agreement to expend certain amounts of money for exploration of the property. In addition, Goldfield agreed to sell 1,900 acres of the Getchell property to Cordilleran Explorations. The Copper Range Exploration Co. at Round Mountain continued to process gold-bearing gravels from its exploratory adit and raises through the 75-ton-per-day gravity concentrator pilot mill. By yearend the company had recessed the work to evaluate results and to determine the feasibility of constructing a 5,000- to 10,000-ton-per-day plant. The Idaho Mining Co. operated a gold heap leaching pilot plant on its gold property in Windfall Canyon southeast of Eureka. Initial experiments used dump material of low-grade gold ores.

The New Pass gold mine, 30 miles west of Austin, is being reactivated under a contract with the Office of Minerals Exploration (OME), U.S. Geological Survey. There is a mill on the property, and some mining and milling has been done in conjunction with the exploration work. The Great Basin Exploration Co. obtained a contract from OME for gold and silver exploration in the Good Hope mining district north of Elko.

Titanium Metals Corp. of America resumed operations at its Henderson titanium sponge plant. The company contracted to deliver 3,250 tons over the next 2 years to the General Services Administration for the strategic stockpile.

The Standard Oil Co. of California con-

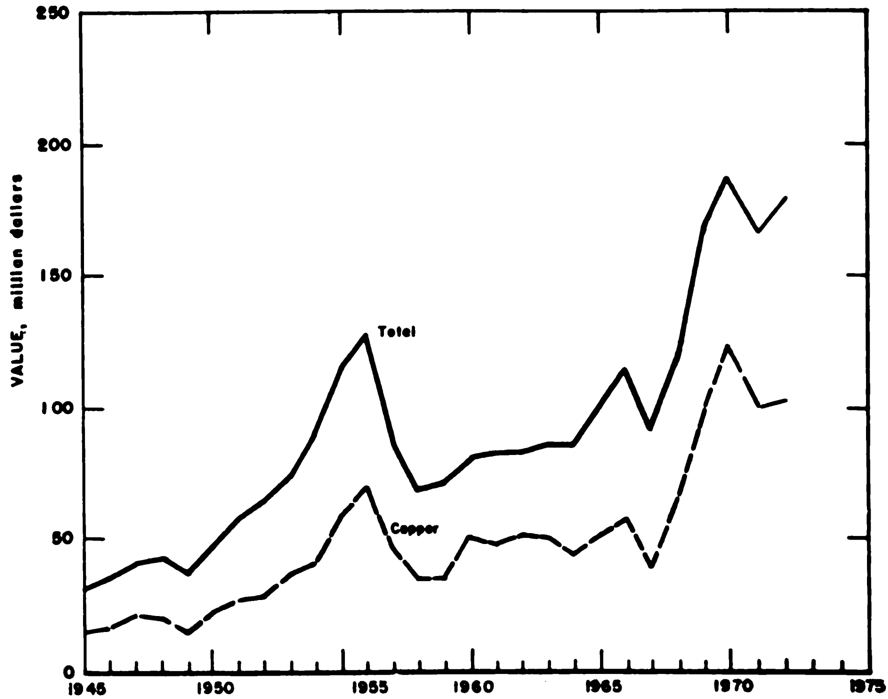

Figure 1.—Value of copper and total value of production in Nevada.

ducted geophysical surveys near Fallon to determine the presence of oil. Gulf Oil Corp. was granted a permit by Washoe County to conduct studies of geothermal power at Steamboat Springs.

Standard Resources Inc. produced silica sand at its open pit Veta Grande property south of Carson City. A 200-ton-per-day processing plant to produce a high-grade silica flour was under construction.

Table 1.—Mineral production in Nevada [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite (crude) .... thousand short tons	192	$1,490	317	$2,659
Clays .... do	W	W	40	183
Copper (recoverable content of ores, etc.) short tons	96,928	100,806	101,119	103,545
Gem stones	NA	105	NA	110
Gold (recoverable content of ores, etc.) troy ounces	374,878	15,464	419,748	24,597
Gypsum .... thousand short tons	695	2,372	860	2,871
Lead (recoverable content of ores, etc.) short tons	111	30	(2)	(2)
Mercury .... 76-pound flasks	1,589	465	810	177
Perlite .... short tons	9,600	114	W	W
Petroleum (crude) .... thousand 42-gallon barrels	113	W	100	W
Pumice .... thousand short tons	112	232	W	W
Sand and gravel .... do	9,379	12,225	10,081	12,636
Silver (recoverable content of ores, etc.) thousand troy ounces	601	930	595	1,003
Stone .... thousand short tons	2,531	3,800	3,329	5,926
Tungsten concentrate ... short tons, 60% WO_3 basis	33	88	165	W
Zinc (recoverable content of ores, etc.) short tons	71	23	--	--
Value of items that cannot be disclosed: Antimony, brucite (1971), cement, diatomite, fluorspar, iron ore, lime, lithium minerals, magnesite, molybdenum concentrates (content), pyrite (1971), salt, talc and soapstone (1972), and values indicated by the symbol W	XX	26,630	XX	27,995
Total	XX	164,774	XX	181,702
Total 1967 constant dollars	XX	140,107	XX	p 151,157

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Less than ½ unit.

Table 2.—Value of mineral production in Nevada, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Carson City [1]	W	$134	Pumice, sand and gravel.
Churchill	$102	W	Sand and gravel, salt, stone, tungsten.
Clark	16,689	16,769	Sand and gravel, lime, stone, gypsum, clays, gold.
Douglas	W	W	Sand and gravel.
Elko	490	1,253	Sand and gravel, barite, tungsten, copper, stone.
Esmeralda	2,508	3,452	Lithium minerals, diatomite, talc, sand and gravel, tungsten, clays.
Eureka	8,866	12,084	Gold, iron ore, stone, mercury, sand and gravel, antimony.
Humboldt	816	W	Sand and gravel, clays, mercury, gold.
Lander	23,722	31,515	Copper, gold, barite, silver.
Lincoln	482	W	Stone, sand and gravel, perlite, pumice.
Lyon	r 52,114	52,703	Copper, cement, stone, diatomite, sand and gravel, clays.
Mineral	23	W	Tungsten, silver, gold, stone, copper, lead.
Nye	r 2,327	2,047	Magnesite, petroleum, fluorspar, sand and gravel, pumice, clays, tungsten, stone.
Pershing	5,991	7,126	Diatomite, gypsum, copper, sand and gravel, mercury, iron ore, stone, clays, perlite, tungsten, silver, gold, lead.
Storey	W	W	Diatomite, sand and gravel.
Washoe	2,911	3,124	Sand and gravel, pumice, clays, stone.
White Pine	43,992	46,712	Copper, gold, lime, silver, molybdenum, sand and gravel, stone, tungsten.
Undistributed [2]	3,741	4,784	
Total [3]	164,774	181,702	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Independent city, formerly Ormsby County.

[2] Includes gem stones, mercury (1971), tungsten (1971), some sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

The Central Nevada Development Authority was awarded $5,000 for preliminary work on a study to determine the feasibility of building several custom mills and a refinery in central Nevada. Mining organizations in the State feel that these installations utilizing modern technology could revitalize many of the small mines that are now inactive.

Legislation and Government Programs.—Public land orders by the U.S. Bureau of Land Management withdrew 40 acres of land in Clark County from all forms of appropriation including mining and mineral leasing laws, 40.8 acres in Lincoln County from mining only, and an additional 0.3 acre was withdrawn from mineral leasing only. In Pershing County, 307.5 acres was restored for mineral leasing, and 62.5 acres in Clark and Elko Counties was opened to location under the mining laws. Nevada received U.S. Treasury checks totalling $515,747 in bonuses, royalties, and rentals covering mineral leases and permits.

The Bureau of Mines continued to provide consulting service to the Atomic Energy Commission (AEC) on preshot and postshot structural installations in connection with underground nuclear tests on and adjacent to AEC's Nevada Test Site.

The U.S. Geological Survey and Bureau of Mines made mineral studies in the Jarbidge wilderness area of the Humboldt

Table 3.—Indicators of Nevada business activity

	1971	1972[p]	Change, percent
Employment and labor force, annual average:			
Total labor force .... thousands	251.9	267.9	+6.4
Unemployed .... do	16.4	17.7	+7.9
Employment:			
Mining .... do	3.6	3.4	−5.6
Contract construction .... do	13.1	14.5	+10.7
Manufacturing .... do	8.6	9.3	+8.1
Government .... do	38.1	39.7	+4.2
Other .... do	172.1	183.3	+6.5
Personal income:			
Total .... millions	$2,460	$2,748	+11.7
Per capita	$4,822	$5,215	+8.2
Construction activity:			
Valuation of private authorized nonresidential construction .. millions	$60.2	$106.1	+76.2
Total authorized residential units	13,075	16,702	+27.7
Cement shipments to and within Nevada .... thousand short tons	413	402	−2.7
Farm marketing receipts .... millions	$92.7	$113.1	+22.0
Mineral production value .... do	$164.8	$181.7	+10.2

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	1,839	302	556	4,462	2	72	16.58	3,314
Nonmetal	764	250	191	1,534	--	42	27.37	1,143
Sand and gravel	450	193	87	750	1	10	14.67	8,190
Stone	298	289	86	712	--	16	22.48	770
Total[1]	3,351	274	919	7,458	3	140	19.17	3,115
1972:[2]								
Metal	1,460	320	467	3,761	1	64	17.28	2,178
Nonmetal	665	251	167	1,360	--	31	22.80	1,096
Sand and gravel	345	191	66	541	1	6	12.93	11,290
Stone	250	283	70	561	1	17	32.08	11,656
Total[1]	2,715	284	770	6,223	3	118	19.44	3,589

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

National Forest in Elko County. The purpose was to determine the mineral values and their potential.

The research program at the Bureau of Mines Reno Metallurgy Research Center was directed toward applied research, particularly with respect to shorter range, problem-oriented projects. Much emphasis was placed on hydrometallurgical and electrometallurgical research, such as the hydrometallurgy of copper, electrooxidation treatment for recovery of gold, silver, mercury, molybdenum, and rhenium, and fused-salt electrowinning of rare-earth alloys and mischmetal. All of the in-house research conducted at the Boulder City Metallurgy Research Laboratory was concerned with investigating new large-scale uses for sulfur. Tests were made to evaluate sulfur-asphalt-sand formulations for highway and airport surfacing, sulfur and sulfur compounds to form impervious layers for leach or holding ponds to prevent land pollution, and construction materials modified with sulfur. Grants were issued to develop information on mineral recovery from geothermal brines.

REVIEW BY MINERAL COMMODITIES

METALS

Copper.—Copper output increased 4% above that of 1971, making the State the Nation's fifth largest copper producer. Most of the output came from operations of The Anaconda Company, Lyon County; Kennecott Copper Corp., White Pine County; and Duval Corp., Lander County. Kennecott processed almost 7 million tons of 0.97% ore in 1972.

Ranchers Exploration & Development Corp. maintained its production goal of about 100,000 pounds of copper per month from its Big Mike mine near Winnemucca. Cliffs Copper Corp. produced a small

Table 5.—Nevada: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing		Material sold or treated (short tons)[1]	Gold		Silver	
	Lode	Placer		Troy ounces	Value	Troy ounces	Value
1970, total	88	1	20,142,006	480,144	$17,472,828	718,011	$1,271,468
1971, total	18	1	r18,670,707	874,878	15,463,719	601,470	929,872
1972:							
Clark	--	1	--	12	708	--	--
Eureka	1	--	1,000,167	194,306	11,386,332	--	--
Humboldt	--	1	--	9	527	--	--
Lyon	1	--	9,858,453	--	--	--	--
Pershing	2	1	150,094	5	298	1,825	3,075
White Pine	2	--	6,889,129	21,606	1,266,112	116,202	195,800
Other [2]	4	--	3,953,226	203,810	11,943,266	477,324	804,291
Total	10	3	21,351,069	419,748	24,597,233	595,351	1,003,166

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1970, total	106,688	$123,118,472	364	$113,831	127	$39,036	$142,015,135
1971, total	96,928	100,805,588	111	30,540	71	22,974	117,252,698
1972:							
Clark	--	--	--	--	--	--	708
Eureka	--	--	--	--	--	--	11,386,332
Humboldt	--	--	--	--	--	--	527
Lyon	41,115	42,102,257	--	--	--	--	42,102,257
Pershing	603	617,711	(3)	26	--	--	621,105
White Pine	43,552	44,596,793	--	--	--	--	46,058,705
Other [2]	15,848	16,228,664	(3)	5	--	--	28,976,226
Total	[4] 101,119	103,545,425	(3)	31	--	--	129,145,855

[1] Does not include gravel washed.

[2] Includes Elko, Lander, and Mineral Counties combined to avoid disclosing individual company confidential data.

[3] Less than ½ unit.

[4] Data does not add to total shown because of independent rounding.

amount of copper from its Mountain City mine in Elko County.

A negligible quantity of copper was recovered as a byproduct from silver ores.

Gold.—Nevada was the Nation's leading gold producer with 29% of the total U.S. output. Two lode gold mines provided most of the total production. The balance was produced primarily as byproduct gold from copper ores and from several small placer operations.

Carlin Gold Mining Co., Eureka County, reported gold production of 194,306 troy ounces. The life of the operation was to be extended by bringing into production two smaller and lower grade gold ore bodies in the same area, the Bootstrap and Blue Star mines. Reserves at Carlin at the end of 1972 were 2,713,000 tons of ore assaying 0.317 ounce of gold per ton.

Cortez Gold Mines in Lander County substantially increased its gold production, most of which came from milling operations and a lesser amount from heap leaching of low grade ore. The company completed negotiations for the mining and milling of an estimated 900,000 tons of ore assaying 0.13 ounce of gold per ton at Gold Acres near the present plant. In addition, approximately 2 million tons of low-grade ore will be heap-leached at the same location.

Iron Ore.—Three mines were active in 1972, compared with four in 1971. Usable iron ore production and shipments declined substantially because of the cessa-

Table 6.—Nevada: Mine production of gold, silver, copper, lead, and zinc in 1972, by class of ore or other source material, in terms of recoverable metal

Source	Number of mines [1]	Material sold or treated (thousand short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold and dry silver [2] [3]	4	3,320	384,953	2,843	(4)	(4)	--
Copper [3]	4	18,016	34,771	592,508	89,842	--	--
Total	8	21,336	419,724	595,351	89,842	(4)	--
Other lode material:							
Copper precipitates	4	15	--	--	11,276	--	--
Placer	3	--	24	--	--	--	--
Grand total	13	21,351	419,748	595,351	[5] 101,119	(4)	--

[1] Detail will not necessarily add to totals shown because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Includes material that was heap leached.
[4] Less than ½ unit.
[5] Data does not add to total shown because of independent rounding.

Table 7.—Nevada: Mine production of gold, silver, copper, lead, and zinc in 1972, by type of material processed and method of recovery, in terms of recoverable metal

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Cyanidation	384,934	--	--	--	--
Smelting of concentrates	34,398	589,626	71,440	--	--
Leaching	(1)	--	18,033	--	--
Direct smelting of—					
Ore	392	5,725	370	(2)	(2)
Copper precipitates	--	--	11,276	--	--
Total	34,790	595,351	101,119	--	--
Placer	24	--	--	--	--
Grand total	419,748	595,351	101,119	(2)	(2)

[1] Included in cyanidation.
[2] Less than ½ unit.

tion of operations in 1971 by Standard Slag Co. at its Minnesota mine in Douglas County. Direct shipping-grade ores were produced by Nevada-Barth Corp., Eureka County, and by Cooney Brothers and Nevada Iron Ore Co., Inc., both in Pershing County.

Mercury.—Production of mercury decreased 49% from that of 1971, but the State retained its position as the Nation's second largest producer with 11% of the total. Crofoot Tungsten Co. produced mercury at its Red Bird mine in Pershing County but closed the operation early in the year. Small quantities were produced by Sierra Mineral Management from its Cordero mine in Humboldt County and by Golden Cycle Technology Corp. from its Pershing mine in Pershing County. Golden Cycle produced some metal but output was mostly cinnabar concentrate for export. The Carlin Gold Mining Co., which produced mercury as a byproduct from its gold mine in Eureka County, was the only continuous producer of prime virgin mercury in Nevada. Kollsman Mineral and Chemical Co. announced its intention to sell all the equipment at the B & B mine in Nye County.

Table 8.—Nevada: Mercury production, by method of recovery

Year	Recovery method					Total	
	Operating mines	Furnaced		Retorted			
		Ore treated (short tons)	76-pound flasks [1]	Ore treated (short tons)	76-pound flasks	76-pound flasks	Value [2] (thousands)
1968	17	67,711	4,825	5,842	455	4,780	$2,560
1969	24	108,715	[3] 7,735	[4] 9,985	430	8,165	4,124
1970	13	89,200	4,884	258	25	4,909	2,001
1971	8	18,960	1,571	[5] 268	18	1,589	465
1972	3	W	W	W	W	810	177

W Withheld to avoid disclosing individual company confidential data.

[1] Includes less than 100 flasks of byproduct mercury.

[2] Value calculated at average New York price.

[3] Includes mercury recovered from old surface ores, dumps, and placers.

[4] Includes 1,800 short tons of tailings.

[5] Includes ore treated in concentrators prior to retorting.

Molybdenum.—Molybdenum was recovered by Kennecott Copper Corp. as a coproduct of treating copper ores from the Ruth mine in White Pine County. Production increased substantially, but shipments were slightly lower than in 1971.

Silver.—The production of silver from two lode silver mines decreased 1% from that of 1971. Copper ores yielded most of the total lode silver, which came from two mines.

Tungsten.—The number of producing tungsten properties decreased from 28 in 1971 to 13 in 1972, but tungsten concentrate production increased 400%. The sharp increase was attributed to Rawhide Mining Co. starting tungsten production from its Scheelite mine near Rawhide, Mineral County. The company leased the property from Kennametal Inc. Most of the State's output was shipped to the tungsten carbide plant of Kennametal in Churchill County. A small amount was shipped to the Pine Creek ammonium paratungstate plant of Union Carbide Corp. near Bishop, Calif.

NONMETALS

Barite.—The quantity of primary barite sold or used by Nevada producers was up 65% from that of 1971. Most of the increased production came from Dresser Minerals' Battle Mountain mine and the startup of the Dolezal-Layton mine of Milchem, Inc., both in Lander County. Sales of ground barite, including tonnages used by producers, increased by 78%. Most of the ground and crushed barite was sold for use in well drilling.

Cement.—Portland cement was produced by Nevada Cement Co. in a dry-process plant at Fernley, Lyon County. Shipments decreased 4%, but the value increased 8% from those of 1971. Most of the cement was used by ready-mix concrete and concrete products manufacturers, building material dealers, and highway contractors.

Total consumption of cement in Nevada, including material received from out-of-State, was 402,309 tons, 2.7% less than in 1971.

Clays.—Clays sold or used increased in quantity compared with the 1971 total. Common clay was obtained from a deposit near Flanigan, Washoe County, by Nevada Cement Co. for use at the company cement plant in Lyon County. Kelley-Moore Paint Co., Inc., mine kaolin near Lovelock, Pershing County, and bentonite from two mines near Weeks, Lyon County. Western Talc Co. mined bentonite at the New Discovery mine in Nye County, the Toddy mine in Clark County, and the Blanco mine in Esmeralda County.

Diatomite.—Sales of prepared diatomite increased 9% in quantity and 8% in value compared with those of 1971. As in 1971, four deposits were mined. Eagle-Picher Industries, Inc., remained the largest Nevada producer from its Celatom mine in Pershing County, and the Tunnel Hill mine in Storey County. GREFCO, Inc., the second largest producer, operated its mine at Basalt and a plant near Mina, both in Esmeralda County. United Sierra Division of Cyprus Mines Corp. supplied diatomite from its mine in Churchill County to its plant at Fernley, Lyon County. Product sales were mainly for filtration filler and lightweight aggregate.

Fluorspar.—Production and shipments of metallurgical-grade fluorspar were about one-third lower than in 1971. J. Irving Crowell, Jr., Nye County, was the only producer.

Gypsum.—The Flintkote Co., Johns-Manville Products Corp., and United States Gypsum Co. mined crude gypsum in Clark and Pershing Counties. Output increased 24% to a record 859,600 tons. The three companies produced 562,900 tons of calcined gypsum in Clark and Washoe Counties, a 71% increase over that of 1971. Sales of gypsum for gypsum board were mainly responsible for the increase.

Lime.—The Flintkote Co. and Morrison & Weatherly Chemical Products produced lime in Clark and White Pine Counties for open-hearth steel furnaces, finishing lime, copper ore concentration, and other uses. Output increased 2% but was 3% below the 1969 record. Total consumption of lime in Nevada was 51,640 tons.

Lithium Compounds.—The output of lithium carbonate from the Silver Peak facility of Foote Mineral Co. in Esmeralda County increased 50% compared with that of 1971. The company reported a moderate increase in sales to the ceramic and glass industry, and a dramatic increase in shipments to the aluminum industry.

Magnesite and Brucite.—Basic Inc., the only domestic producer of magnesite and brucite, operated an open pit mine at Gabbs, Nye County, and upgraded the ore in nearby processing facilities. Production of magnesite was up slightly in 1972 compared with that of 1971. Most of the ore was used in the manufacture of refractories and special products.

Perlite.—As in 1971 three companies produced all of the crude perlite. United States Gypsum Co. (Pearl Hill quarry) operated a mine in Pershing County, and Delamar Perlite worked the Mackie claims in Lincoln County. Most of the crude perlite output was sold to out-of-State consumers. Total sales, however, declined for the 15th consecutive year.

Pumice (Volcanic Cinder).—Output of pumice, pumicite, and volcanic cinder was almost twice that of 1971. The increase was due primarily to greater demand in concrete aggregate. Use in concrete admixtures and road construction was down somewhat from the 1971 level, but demand increased for volcanic cinder in landscaping. Cind R Lite Co. mined volcanic cinder from the Cinder Cone deposit southeast of Beatty, Nye County, for landscaping and concrete aggregate use. Volcanic cinder from the Cinderlite Aggregates property of Savage Construction Co., Inc., Carson City, was prepared for use in concrete aggregates, road construction, landscaping, and roofing. Pumicite from the Lory Free pit of Pozzolan Portland Cement Co. Lincoln County, was prepared for use in concrete admixtures. Pumicite from the Rilite Aggregate Co., Washoe County, was prepared for use in concrete aggregate.

Salt.—The sole salt producer in the State was Huck Salt Co., which operated the Leslie Salt Co. solar evaporation plant in Churchill County. All of the production, which was about the same as that of 1971, was used in Nevada. Most of the output was sold for use in ice control on roads by State, county, and local agencies. The remainder was used in the meatpack-

Table 9.—Nevada: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Carson City [1]	2	17	12	4	120	58
Clark	22	5,088	7,636	23	5,571	7,061
Elko	10	483	409	10	259	1,095
Eureka	2	28	27	1	W	7
Humboldt	6	815	433	4	82	75
Lander	1	8	11	--	--	--
Lincoln	3	79	87	2	W	78
Lyon	9	195	262	4	141	215
Mineral	1	22	21	--	--	--
Nye	3	248	191	3	W	W
Pershing	3	56	64	3	135	166
Storey	--	--	--	1	37	41
Washoe	12	2,039	2,661	15	2,567	2,697
White Pine	6	69	110	8	92	77
Undistributed [2]	4	232	302	6	1,077	1,066
Total	84	9,379	[3] 12,225	84	10,081	12,636

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Independent city, formerly Ormsby County.

[2] Includes Churchill, Douglas, and Esmeralda (1972) Counties and some sand and gravel that cannot be assigned to specific counties.

[3] Data do not add to total shown because of independent rounding.

Table 10.—Nevada: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	895	1,448	945	1,454
Fill	195	244	546	397
Paving	155	508	174	218
Other uses [1]	289	1,278	279	1,274
Total [2]	1,534	3,479	1,945	3,343
Gravel:				
Building	1,172	1,920	1,974	2,294
Fill	1,483	1,297	471	520
Paving	1,934	2,620	2,842	3,885
Other uses [3]	385	875	492	648
Total [2]	4,975	6,712	5,778	7,347
Government-and-contractor operations:				
Sand:				
Fill	45	32	25	25
Paving	535	498	704	759
Other uses	1	1	(4)	(4)
Total	581	531	729	784
Gravel:				
Building	36	71	4	3
Fill	11	6	70	49
Paving	2,241	1,421	1,556	1,109
Other uses	2	4	--	--
Total [2]	2,290	1,503	1,630	1,161
Total sand and gravel [2]	9,379	12,225	10,081	12,636

W Withheld to avoid disclosing individual company confidential data: included with "Other uses."

[1] Includes glass, molding, fire-furnace, foundry (1972), and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes miscellaneous gravel.

[4] Less than ½ unit.

ing, tanning, casing, and dairy industries, in feed mixes, and by water-conditioning service companies and metal processors.

Sand and Gravel.—Output of sand and gravel rose from 9.4 million tons in 1971 to 10.1 million tons in 1972. There were 84 sand and gravel operations, the same as in 1971. Of these, 61 were classified as commercial and 23 were classified as Government-and-contractor. Most of the increased output came from Clark and Washoe Counties.

Stone.—About 3.3 million tons of stone were quarried from 22 locations, compared with 2.5 million tons from 17 locations in 1971. The increase was due mostly to a larger output of limestone and smaller increases in the production of dolomite and quartzite.

Most of the limestone was converted to lime, or used in cement. Some was also used as a metallurgical flux, primarily in the smelting of copper. Most of the granite and quartzite was used in road construction. Marble was quarried in Mineral County for terrazzo.

Public work crews and contractors produced limestone and quartzite in several counties for use as riprap, road base, and concrete aggregate.

MINERAL FUELS

Petroleum.—The Eagle Springs oilfield remained the only producing area in the State. Production was 99,985 barrels, compared with 112,951 barrels in 1971. The field has yielded a total of 2,625,657 barrels of oil through December 1972. The Nevada Oil and Gas Conservation Commission issued four well drilling permits in 1972, up from three issued in 1971. Two wells in White Pine County were not yet drilled, and one well in Lincoln County was plugged and abandoned.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Barite:			
Baroid Division, N L Industries, Inc.	P.O. Box 1675 Houston, Tex. 77001	Open pit mine	Elko.
Dresser Minerals Division, Dresser Industries, Inc.	P.O. Box 94 Houston, Tex. 77005	do	Lander.
FMC Corp	P.O. Box 3808 Modesto, Calif. 95352	do	Do.
Milchem, Inc., Mineral Division.	P.O. Box 22111 Houston, Tex. 77027	do	Do.
Brucite:			
Basic Inc	845 Hanna Bldg. Cleveland, Ohio 44115	do	Nye.
Cement:			
Nevada Cement Co	Fernley, Nev. 89408	Dry-process, portland-cement plant.	Lyon.
Clays:			
Nevada Cement Co	do	Open pit mine	Washoe.
Copper:			
The Anaconda Company	P.O. Box 1000 Weed Heights, Nev. 89448	do	Lyon.
Duval Corp	P.O. Box 451 Battle Mountain, Nev. 89820	do	Lander.
Kennecott Copper Corp., Nevada Mines Division.	McGill, Nev. 89318	do	White Pine.
Ranchers Exploration & Development Corp.	P.O. Box 803 Winnemucca, Nev. 89445	do	Pershing.
Diatomite:			
Eagle-Picher Industries, Inc.	P.O. Box 1869 Reno, Nev. 89505	do	Pershing and Storey.
GREFCO, Inc	3450 Wilshire Boulevard Los Angeles, Calif. 90010	do	Esmeralda.
United Sierra Division, Cyprus Mines Corp.	P.O. Box 1201 Trenton, N.J. 08606	do	Churchill.
Fluorspar:			
J. Irving Crowell, Jr	P.O. Box 96 Beatty, Nev. 89003	Underground mine.	Nye.
Gold:			
Carlin Gold Mining Co	P.O. Box 672 Elko, Nev. 89801	Open pit mine	Eureka.
Cortez Gold Mines	Cortez, Nev. 89821	do	Lander.
Duval Corp	P.O. Box 451 Battle Mountain, Nev. 89820	do	Do.
Kennecott Copper Corp., Nevada Mines Division.	McGill, Nev. 89318	do	White Pine.
Gypsum:			
The Flintkote Co	P.O. Box 2678 Terminal Annex Los Angeles, Calif. 90054	do	Clark.
Johns-Manville Products Corp.	4301 East Firestone Blvd. South Gate, Calif. 90280	do	Do.
U.S. Gypsum Co	101 South Wacker Drive Chicago, Ill. 60606	do	Pershing.
Iron ore:			
Nevada-Barth Corp	P.O. Box 425 Carlin, Nev. 89822	do	Eureka.
Lime:			
The Flintkote Co	P.O. Box 57367 Flint Station Los Angeles, Calif. 90057	Rotary kilns, batch and continuous hydrators.	Clark.
Morrison & Weatherly Chemical Products.	P.O. Box 1105 McGill, Nev. 89318	Rotary kilns	White Pine.
Lithium:			
Foote Mineral Co	Route 100 Exton, Pa. 19341	Dry lake brines	Esmeralda.
Magnesite:			
Basic Inc	845 Hanna Bldg. Cleveland, Ohio 44115	Open pit mine	Nye.
Mercury:			
Carlin Gold Mining Co	P.O. Box 672 Elko, Nev. 89801	do	Eureka.
Crofoot Tungsten Co	Rt. 2 Box 625 B Ukiah, Calif. 95482	Underground mine.	Pershing.
Molybdenum:			
Kennecott Copper Corp., Nevada Mines Division.	McGill, Nev. 89318	Open pit mine	White Pine.
Perlite:			
Delamar Perlite	Pioche, Nev. 89043	Underground mine.	Lincoln.
United States Gypsum Co	101 South Wacker Drive Chicago, Ill. 60606	Open pit mine	Pershing.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum:			
North American Resources Corp.	811 San Jacinto Bldg. Houston, Tex. 77002	Producing crude-oil wells.	Nye.
Western Oil Lands, Inc	380 Linden St. Reno, Nev. 89502	do	Do.
Pumice:			
Rilite Aggregate Co	P.O. Box 5665 Reno, Nev. 89503	Open pit mine	Washoe.
Savage Construction Co., Inc.	P.O. Box 970 Carson City, Nev. 89701	do	Carson City.
Salt:			
Leslie Salt Co	Route 2, P.O. Box 33 Fallon, Nev. 89406	Dry lake brines	Churchill.
Sand and gravel:			
Bing Materials Co	P.O. Box 487 Minden, Nev. 89423	Open pit mine	Douglas.
R. Helms Construction Co	3025 Mill St. Reno, Nev. 89502	do	Washoe.
Las Vegas Building Materials, Inc.	P.O. Box 580 Las Vegas, Nev. 89101	do	Clark.
Nevada Aggregates & Asphalt.	P.O. Box 7424 Reno, Nev. 89502	do	Washoe.
Nevada Rock & Sand Co	P.O. Box 2775, Huntridge Station Las Vegas, Nev. 89101	do	Clark.
Reynolds Elec. & Engr. Co. Inc	Box 14400 Las Vegas, Nev. 89114	do	Nye.
Stewart Brothers Co	P.O. Box 2775, Huntridge Station Las Vegas, Nev. 89101	do	Do.
Stock Mill & Supply Co	3336 Cinder Lane Las Vegas, Nev. 89103	do	Nye.
Wells-Cargo, Inc	2894 West Spring Mountain Rd. Las Vegas, Nev. 89114	do	Do.
W. M. K. Transit Mix, Inc.	1606 Industrial Rd. Las Vegas, Nev. 89102	do	Do.
Silver:			
Duval Corp	P.O. Box 451 Battle Mountain, Nev. 89820	do	Lander.
Kennecott Copper Corp., Nevada Mines Division.	McGill, Nev. 89318	do	White Pine.
Stone:			
Nevada Cement Co	Fernley, Nev. 89408	Quarry	Lyon.
U.S. Lime Division, The Flintkote Co.	P.O. Box 57367 Flint Station Los Angeles, Calif. 90057	do	Clark.
Wells Cargo, Inc	2894 West Spring Mountain Rd. Las Vegas, Nev. 89114	do	Do.
Tungsten:			
Henry C. & John Crofoot	P.O. Box 797 Lovelock, Nev. 89419	Open pit mine	Churchill.

The Mineral Industry of New Hampshire

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New Hampshire Department of Resources and Economic Development for collecting information on all minerals except fuels.

By Avery H. Reed[1]

The total value of mineral production in New Hampshire decreased to $10.1 million, 2% below the 1971 record. Among the States, New Hampshire ranked 48th in total value of mineral production.

Leading producing counties were Hillsboro, Merrimack, and Rockingham. Leading producers were Kitledge Granite Corp., with a dimension granite quarry in Hillsboro County; Manchester Sand, Gravel, & Cement Co., with a sand and gravel pit in Merrimack County; and Ossipee Aggregate Corp., with a sand and gravel pit in Carroll County. These three companies accounted for 30% of the total mineral production value for the State.

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[1] Physical scientist, Division of Nonmetallic Minerals.

Table 1.—Mineral production in New Hampshire[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays..........thousand short tons..	37	$34	51	$70
Gem stones..........	NA	40	NA	42
Sand and gravel..........thousand short tons..	8,404	6,777	6,020	6,256
Stone..........do....	429	3,433	528	3,743
Total..........	XX	10,284	XX	10,111
Total 1967 constant dollars..........	XX	8,744	XX	[p]8,411

[p] Preliminary. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in New Hampshire, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Belknap..........	W	W	Sand and gravel.
Carroll..........	W	W	Sand and gravel, stone.
Cheshire..........	W	W	Sand and gravel.
Coos..........	W	$396	Do.
Grafton..........	$956	667	Sand and gravel, stone, clays.
Hillsboro..........	3,341	3,114	Stone, sand and gravel.
Merrimack..........	2,141	2,100	Sand and gravel, stone.
Rockingham..........	595	1,070	Sand and gravel, stone, clays.
Strafford..........	351	313	Sand and gravel, clays, stone.
Sullivan..........	W	W	Sand and gravel.
Undistributed[1]..........	2,898	2,450	
Total[2]..........	10,284	10,111	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of New Hampshire business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force……thousands..	307.0	316.1	+3.0
Unemployment……percent of work force..	4.9	4.5	−8.2
Employment:			
Manufacturing employment……thousands..	85.5	89.8	+5.0
Durable goods……do….	40.0	42.6	+6.5
Nondurable goods……do….	45.6	47.2	+3.5
Nonmanufacturing employment……do….	173.5	180.4	+4.0
Mining and construction……do….	13.1	14.5	+10.7
Factory payrolls:			
Average weekly hours……	39.1	39.7	+1.5
Average hourly earnings……	$3.03	$3.20	+5.6
Personal income:			
Total……millions..	$2,877	$3,155	+9.7
Per capita……	$3,796	$4,092	+7.8
Construction activity:			
Total construction contracts……thousands..	r 157.5	172.9	+9.8
Cement shipments to and within New Hampshire thousand short tons..	181.0	[1] 243.0	+34.2
Mineral production value……thousands..	$10,284	$10,111	−1.7

p Preliminary. r Revised. NA Not available.

[1] Not directly comparable with previous years. Data in 1972 include cement imported from Canada.

Sources: New England Economic Indicators; Survey of Current Business; Employment and Earnings and Annual Report on the Labor Force; U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Consumption of portland cement was 242,700 tons. Consumption of masonry cement was 12,610 tons. There are no cement plants in New Hampshire.

Clays.—Densmore Brick Co., W.S. Goodrich, Inc., and The Kane-Gonic Brick Corp. mined 50,750 tons of common clay for common and face brick. Output increased 37% and was 26% above the 1970 record. The clay was mined in Grafton, Rockingham, and Strafford Counties.

Table 4.—New Hampshire: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building……	1,521	1,843	1,695	2,130
Fill……	W	W	636	532
Paving……	428	404	383	407
Other uses [1]……	1,480	655	57	55
Total [2]……	3,429	2,902	2,770	3,124
Gravel:				
Building……	805	1,373	999	1,549
Fill……	927	628	307	225
Paving……	565	805	475	739
Other uses [3]……	447	424	264	314
Total [2]……	2,744	3,231	2,045	2,827
Government-and-contractor operations:				
Sand: Paving……	653	227	189	59
Gravel:				
Fill……	--	--	39	5
Paving……	1,578	417	977	241
Total……	1,578	417	1,016	246
Total sand and gravel……	8,404	6,777	6,020	6,256

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes other industrial sand (1971).

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1971), miscellaneous, and other gravel.

Gem Stones.—The value of gem stones and mineral specimens collected was estimated at $42,000.

Gypsum.—National Gypsum Co. calcined gypsum at Portsmouth. Output increased 7% for a new annual record. The crude gypsum was imported from Canada.

Lime.—Consumption of lime was 2,000 tons.

Perlite.—National Gypsum Co. expanded perlite at Portsmouth. Output decreased 29% below the 1971 record.

Sand and Gravel.—Twenty-seven operators mined sand and gravel at 37 mines in 10 counties for building, paving, fill, and other uses. Output decreased to 6.0 million tons, 28% below the 1971 record. The decline was mainly due to decreased production by State agencies. Leading counties were Merrimack, Carroll, and Hillsboro; these three counties accounted for 50% of the total output. Leading producers were the New Hampshire Department of Public Works and Highways, Manchester Sand, Gravel, & Cement Co., Ossipee Aggregate Corp., and Thomopoulis Sand & Gravel Pit; these producers accounted for 44% of the total output.

Stone.—Kitledge Granite Corp. and The John Swenson Granite Co., Inc., quarried dimension granite in Hillsboro and Merrimack Counties for dressed architectural, construction, and monumental stone, and for curbing. Output increased 24% for a new annual record.

Lebanon Crushed Stone, Inc., and Iafolla Construction Co., Inc., crushed traprock in Grafton and Rockingham Counties. Output increased 16%.

The New Hampshire Department of Public Works and Highways crushed granite in Carroll, Grafton, Hillsboro, Merrimack, and Rockingham Counties for roadstone. Output increased to 46,510 tons.

North Country Aggregates, Inc., crushed quartz in Hillsboro County for exposed aggregate in decorative concrete. Output decreased 23%.

Total stone output increased to 527,900 tons, 23% above the 1971 record.

Table 5.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
Densmore Brick Co	Lebanon, N.H. 03766	Pit	Grafton.
W. S. Goodrich, Inc	Epping, N.H. 03042	Pit	Rockingham.
The Kane-Gonic Brick Corp	Gonic, N.H. 03867	Pit	Strafford.
Gypsum (calcined): National Gypsum Co.	825 Delaware Ave. Buffalo, N.Y. 14202	Plant	Rockingham.
Perlite (expanded): National Gypsum Co.	do	do	Do.
Sand and gravel:			
R. S. Audley, Inc	Rt. 3A, Bow, N.H. 03302	Pit	Merrimack.
Campton Sand & Gravel, Inc	Box 2, West Campton, N.H. 03228	Pit	Grafton.
Cold River Sand & Gravel Corp	P.O. Box 429 Bellows Falls, Vt. 05101	Pit	Cheshire.
J. J. Cronin Co	P.O. Box 176 North Reading, Mass. 01864	Pit	Hillsboro.
Iafolla Construction Co., Inc	Peverly Hill Rd. Portsmouth, N.H. 03801	Pit	Rockingham, Strafford.
Keene Sand & Gravel, Inc	725 Main St. Keene, N.H. 03431	Pit	Cheshire.
Lessard Sand & Gravel, Inc	Lancaster Rd. Gorham, N.H. 03581	Pit	Coos.
Manchester Sand, Gravel & Cement Co.	P.O. Box 415 Hooksett, N.H. 03106	Pit	Merrimack.
Nashua Sand & Gravel	Route 130, Nashua, N.H. 03060	Pit	Hillsboro.
Ossipee Aggregate Corp	Rt. 16 Ossippee, N.H. 03864	Pit	Carroll.
Thomopoulis Sand & Gravel Pit	Londonderry, N.H. 03053	Pit	Rockingham.
Tilton Sand & Gravel, Inc	Tilton, N.H. 03276	Pit	Belknap.
Stone:			
Granite, dimension:			
Kitledge Granite Corp	Oak St. Milford, N.H. 03055	Quarry	Hillsboro.
The John Swenson Granite Co., Inc.	North State St. Concord, N.H. 03301	do	Merrimack.
Quartz, crushed: North Country Aggregates, Inc.	P.O. Box 55 South Lyndeboro, N.H. 03082	do	Hillsboro.
Traprock, crushed:			
Iafolla Construction Co., Inc	Peverly Hill Rd. Portsmouth, N.H. 03801	do	Rockingham.
Lebanon Crushed Stone, Inc	Plainfield Rd. West Lebanon, N.H. 03784	do	Grafton.

The Mineral Industry of New Jersey

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New Jersey Division of Natural Resources, Bureau of Geology and Topography, for collecting information on all minerals except fuels.

By Donald C. Wininger [1]

The value of New Jersey's mineral production totaled $113.8 million, 21% over that of 1971, establishing a new high for the fourth consecutive year. Value of sand and gravel output, one of the State's major mineral products, decreased 1%. The leading commodity continued to be stone, which accounted for 47% of the total value of all minerals produced. Somerset was the leading mineral-producing county and was followed, in descending order of value, by Sussex, Cumberland, Morris, Passaic, and Ocean Counties. Mineral production was reported for all counties except Salem County.

Table 1.—Mineral production in New Jersey [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays .... thousand short tons	201	$864	212	$856
Gem stones	NA	15	NA	16
Peat .... thousand short tons	46	526	W	W
Sand and gravel .... do	18,511	38,279	17,679	38,020
Stone [2] .... do	13,469	36,057	13,651	53,083
Zinc (recoverable content of ores, etc.) ... short tons	29,977	9,653	33,096	13,524
Value of items that cannot be disclosed: Greensand marl, lime, magnesium compounds, manganiferous residuum, stone (dimension), titanium concentrate (ilmenite), and value indicated by symbol W	XX	[r] 8,178	XX	8,261
Total	XX	[r] 93,572	XX	113,760
Total 1967 constant dollars	XX	79,564	XX	[p] 94,687

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Values of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes certain dimension stone, included with "Value of items that cannot be disclosed."

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[1] Physical scientist, Division of Nonmetallic Minerals.

Table 2.—Value of mineral production in New Jersey, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Atlantic	$185	$373	Sand and gravel.
Bergen	W	1,267	Do.
Burlington	1,621	W	Sand and gravel, clays.
Camden	2,506	1,605	Do.
Cape May	W	W	Magnesium compounds, sand and gravel.
Cumberland	13,774	15,051	Sand and gravel, clays.
Essex	W	W	Stone.
Gloucester	503	546	Greensand marl, sand and gravel.
Hudson	W	1,678	Stone.
Hunterdon	2,696	2,920	Do.
Mercer	W	W	Do.
Middlesex	2,313	2,023	Sand and gravel, clays.
Monmouth	1,444	1,273	Sand and gravel.
Morris	7,405	7,760	Sand and gravel, stone.
Ocean	r 6,761	7,208	Sand and gravel, titanium concentrate (ilmenite).
Passaic	7,877	7,599	Stone, sand and gravel.
Somerset	15,029	30,530	Stone, clays.
Sussex	17,247	21,921	Zinc, stone, sand and gravel, lime, peat, manganiferous residuum.
Union	W	W	Stone.
Warren	1,402	1,619	Sand and gravel, stone, peat.
Undistributed [2]	12,812	10,386	
Total[3]	r 93,572	113,760	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Salem County is not included because no production was reported in 1971 or 1972.

[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

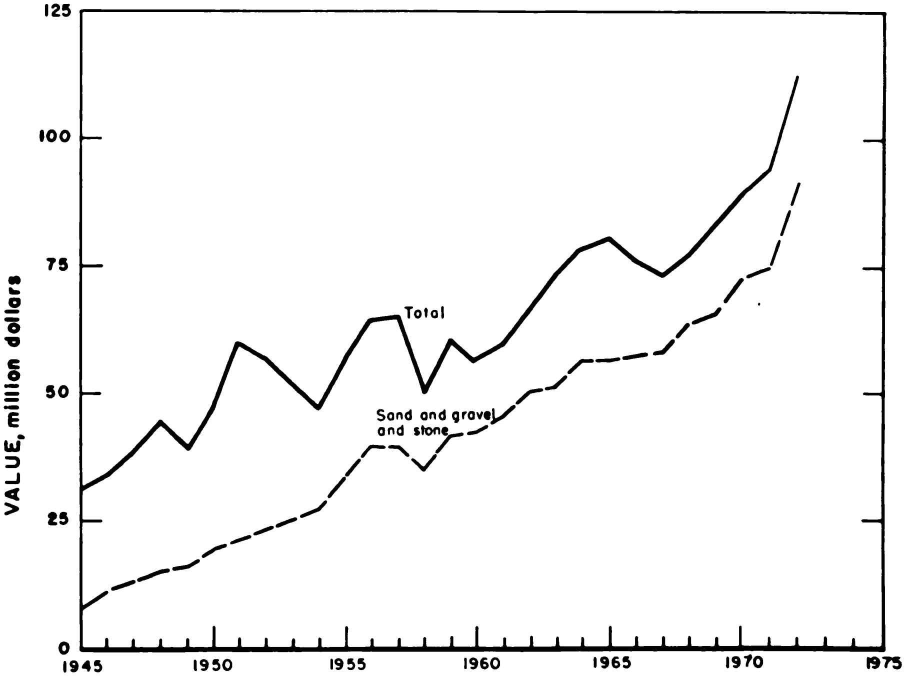

Figure 1.—Value of sand and gravel and stone, and total value of mineral production in New Jersey.

Table 3.—Indicators of New Jersey business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total work force ... thousands	3,138.7	3,195.5	+1.8
Unemployment ... do	217.2	220.0	+1.3
Employment:			
Manufacturing ... do	821.8	814.8	−0.8
Nonmanufacturing:			
Construction ... do	116.3	120.5	+3.6
Transportation and public utilities ... do	181.1	181.6	+0.3
Finance, insurance, and real estate ... do	121.7	124.9	+2.6
Service ... do	419.3	435.0	+3.7
Government ... do	389.3	408.2	+4.8
Mining ... do	3.0	3.2	+6.7
Payroll, average weekly earnings: Manufacturing	$150.29	$163.19	+8.6
Personal income:			
Total ... millions	$35,146	$37,762	+7.4
Per capita	$4,811	$5,126	+6.6
Construction activity:			
Housing units authorized	57,949	63,298	+9.2
Cement shipments to New Jersey ... thousand short tons	2,262	2,254	−0.4
Mineral production value ... thousands	r $93,572	$113,760	+21.6

p Preliminary. r Revised.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	163	298	49	390	1	27	71.72	16,716
Nonmetal	213	212	45	362	1	19	55.20	17,257
Sand and gravel	977	248	242	2,024	--	71	35.08	800
Stone	933	252	236	1,954	--	78	39.92	832
Total	2,286	250	572	4,730	2	195	41.65	3,387
1972: [1]								
Metal	180	298	54	430	--	16	37.23	2,187
Nonmetal	90	233	20	166	--	6	36.13	518
Sand and gravel	775	247	191	1,624	1	37	23.40	4,191
Stone	805	254	205	1,761	2	74	43.15	7,929
Total	1,850	254	470	3,981	3	133	34.16	5,475

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of portland cement into New Jersey totaled 2,174,000 short tons, unchanged from 1971. Masonry cement shipments into New Jersey were 80,000 short tons, 23% less than in 1971. Most of the portland and masonry cement was manufactured in eastern Pennsylvania and eastern New York. Cement was distributed from five terminals, two in Jersey City and one each in Bayonne, Elizabethport, and Newark.

Clays.—The quantity of clay produced increased 6% compared with that produced in 1971, the first increase since 1965. Total value, however, was 1% lower, reflecting a decline in the average unit value. Common clay and shale, used for building brick and heavy clay products, accounted for 72% of the total clay tonnage, but fire clay contributed 43% of the value. Fire clay was used principally for fire brick, foundry clay, and refractory mortar. Common clay and shale were produced in Somerset, Camden and Burlington Counties, in descending order of tonnage. Fire clay was mined in Middlesex and Cumberland Counties. Leading clay producers were Glen-Gery Corp.; New Jersey Shale Brick & Tile Co.; and A. P. Green Refractories Co.

Gem Stones.—Collectors and dealers collected mineral specimens from several localities, mine dumps, and quarries, principally in the northern part of the State. The value of the material collected was estimated to be $16,000, 7% greater than in 1971, reflecting increased activity by amateur mineral collectors during the year.

Gypsum.—Crude gypsum was calcined at four plants, two in Burlington County and one each in Bergen and Camden Counties. The production of 529,000 tons of calcined gypsum valued at $9.8 million was 17% higher than that in 1971. Output was used mainly in the manufacture of wallboard, lath, and sheathing.

Iodine.—Consumption of organic and inorganic iodine by chemical and pharmaceutical companies in the State totaled 684,000 pounds compared with 651,000 pounds in 1971. The iodine was used for medicines, sanitation products, and other chemicals.

Lime.—Limestone Products Corp. of America produced lime in Sussex County for agriculture, water purification, sewage treatment, and other uses. Output declined 22% and was 50% below the 1969 record. Total consumption of lime in New Jersey was 144,800 tons.

Magnesium Compounds.—Production of refractory magnesia declined. An increase in the average unit value, however, was reported. The refractory magnesia was produced in Cape May County from imported dolomite. J. T. Baker Chemical Co., Warren County, converted purchased materials into a variety of magnesium compounds.

Marl, Greensand.—Production of greensand marl was greater in quantity and value than in 1971. Marl, recovered by hydraulic mining from a pit in Gloucester County, was processed and used for water treatment.

Perlite.—Crude perlite mined in Colorado, Nevada, and New Mexico was expanded at three plants, two in Middlesex County and one in Mercer County. Expanded perlite was used primarily in roof insulation board and acoustical plaster; other uses included aggregate for use in ultra-light-weight concrete, loose-fill insulation, soil conditioning and lightweight filler.

Pigments.—Metal-base pigments, used primarily in the manufacture of paint, were produced at a number of plants in New Jersey. Iron oxide pigments were produced by Pigments and Specialties Div., Cities Service Co., in Mercer and Middlesex Counties, and by E. I. du Pont de Nemours & Co., Inc., in Essex County. Titanium dioxide was produced by The New Jersey Zinc Co., Gloucester City, and N L Industries, Inc., near Sayreville. The latter firm also manufactured lead pigments. Zinc oxide pigments were produced by Royce Chemical Co., Carlton Hill.

Sand and Gravel.—The total output of sand and gravel decreased 4.5% from 1971, and the total value was .68% lower. Production of sand and gravel for construction decreased 9% both in quantity and value compared with 1971. Average value per ton decreased $0.01 to $1.48 per ton. Of the 13.5 million tons of sand and gravel used for construction, 1.7 million (12%) was unprocessed. Output of industrial sand for all uses increased 8% both in quantity and value, reflecting an increase of only $0.02 in the average value per ton. Industrial sand accounted for 20% of the tonnage and 44% of the value of all sand and gravel produced in the State. Most of the industrial sand was produced in Cumberland County, where most operations used suction pumps mounted on barges floating on ponds fed by ground water. The sand and water slurry was pumped to processing plants for sizing, grinding, or other treatment. Many of the ponds created by removal of the sand were used for fishing and other recreational activities.

The number of sand and gravel operations decreased to 93 (107 in 1971). Production was reported from 14 of the State's 21 counties and exceeded 1 million tons in each of six counties. Cumberland County ranked first in tonnage and value; its industrial sand accounted for more than one-third of the total value of sand and gravel produced in the State.

Only two operations produced more than 1 million tons, seven produced from 500,000 to 1 million tons, and 37 produced from 100,000 to 500,000 tons. Shipments to consumers were primarily by truck (14.5 million tons) and rail (2.6 million tons).

Table 5.—New Jersey: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Blast	128	799	138	842
Building	5,726	8,678	4,832	7,425
Engine	W	W	25	89
Fill	1,446	1,048	1,105	705
Glass	W	W	1,915	W
Molding	499	2,493	493	2,496
Paving	2,989	3,952	3,440	4,358
Pottery	W	W	52	628
Other uses [1]	3,031	12,439	930	12,665
Total [2]	13,819	29,409	12,929	29,202
Gravel:				
Building	1,977	4,341	1,930	4,428
Fill	1,461	2,076	929	917
Paving	941	1,793	1,147	1,975
Railroad ballast	8	20	--	--
Miscellaneous	219	530	642	1,347
Other uses	78	105	88	141
Total [2]	4,685	8,866	4,736	8,808
Government-and-contractor operations:				
Sand: Other uses	2	2	--	--
Gravel:				
Fill	2	1	--	--
Paving	--	--	13	11
Other uses	3	1	--	--
Total	5	2	13	11
Total sand and gravel	18,511	38,279	17,679	38,020

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes fire or furnace, filtration, railroad ballast, and other sands.

[2] Data may not add to totals shown because of independent rounding.

Stone.—An increase in the level of building activity, especially highway construction, in the State's northern and northwestern counties, caused an increase in the demand for stone aggregates. Total stone production increased 38% in quantity and 47% in value from the 1971 level. Stone was quarried in 10 counties, led by Somerset, Passaic, Sussex, and Hunterdon Counties, in decreasing order of value. Types of stone produced, in decreasing order of tonnage, were basalt, granite, limestone, and sandstone.

Basalt (traprock) continued as the leading type of stone quarried and accounted for 81% of the State's total stone production both in quantity and value. Output of 15.2 million tons was 45% higher than in 1971; average value increased from $2.56 per ton to $2.82. Somerset County with 10.1 million tons and Passaic County with 21 million tons were the leading basalt producers. Basalt quarries were also active in Essex, Hudson, Hunterdon, Mercer and Union Counties. Ninety-six percent of the output was used as aggregate for highway and building construction, but quantities also were sold for riprap and other uses.

Granite production increased 12% to 2.54 million tons. Average value increased $0.10 per ton to $2.16. Quarries were operated at six locations in Hunterdon, Morris, Passaic and Sussex Counties. Small quantities were sold for riprap and fill; the bulk of the output was used for concrete aggregate and roadstone.

Crushed limestone was produced at two quarries in Sussex County and one in Warren County. Output was 32% higher than that of 1971, but total value increased only about 4%, reflecting a decrease in unit value. The limestone was used principally for agricultural stone (agstone), concrete aggregate, filler, hydrated lime, and poultry grit. Sandstone was quarried for dimension stone and flagstone in Hunterdon County.

Sulfur.—Shipments of byproduct sulfur increased 27% to 67,116 long tons. The total value was only 9% higher because the average price per long ton decreased from $29.24 in 1971 to $25. Elemental sulfur was recovered as a byproduct of petroleum refining at four plants, two in Gloucester County and one each in Union and Middlesex Counties.

Vermiculite.—Exfoliated vermiculite was produced at one plant each in Essex, Mercer, and Middlesex Counties from crude material shipped from other States or imported. The exfoliated vermiculite was used mainly as loose-fill insulation, plaster and lightweight concrete aggregate, and for agricultural purposes.

METALS

Ferroalloys.—Shieldalloy Corp., Newfield, Gloucester County, produced ferroalloys of vanadium, titanium, boron, chromium, columbium, and columbium-nickel.

Titanium.—Both quantity and value of ilmenite concentrate production were higher than in 1971. The average unit value was also higher. Glidden-Durkee Div. of SCM Corp. recovered ilmenite from a sand deposit about 3 miles north of Lakehurst, Ocean County. The material was concentrated and shipped to a company-owned plant at Baltimore, Md., for conversion to titanium dioxide pigment.

American Smelting & Refining Co., continued construction of a plant near Lakehurst to recover ilmenite from beach sand deposits. The concentrates will be shipped to E. I. du Pont de Nemours & Co., in Edge Moor, Del., for use in manufacturing white pigment for paint, plastics, and paper.[2]

Zinc.—The quantity of manganiferous zinc ore mined at Sterling Hill, Sussex County, increased 27% over 1971. The ore was crushed and shipped directly to a company-owned smelter at Palmerton, Pa., where zinc and manganiferous residuum were recovered.

State geologists during the year identified Crooked Swamp in Sussex County as the probable site of a major lead and zinc ore body. Any development of the deposit has been indefinitely postponed as a result of objections from conservationists wishing to preserve the swamp in its natural state. Crooked Swamp is New Jersey's biggest nesting place for the blue heron.

MINERAL FUELS

Peat.—Production and sales of peat declined from the 1971 level. Peat was recovered from bogs near Newton, Stanhope, and Sussex in Sussex County, and from Great Meadows in Warren County. Most of the output was used for general soil improvement, but a small quantity was used in mushroom beds.

Petroleum.—Five petroleum refineries active in the State reported a total crude oil capacity of 531,800 barrels per day. Products recovered included gasoline, fuel oil, asphalt, coke, lubricants, and paraffin.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
Fire clay:			
Crossman Co	P.O. Box 38 South Amboy, N.J. 08879	Pit	Middlesex.
Daniel Goff Division, Jesse S. Morie & Son, Inc.	P.O. Box 35 Mauricetown, N.J. 08329	Pit	Cumberland.
A.P. Green Refractories Co., U.S. Gypsum Co.	Pennval Road Woodbridge, N.J. 07095	Pit	Middlesex.
Miscellaneous clay:			
Church Brick Co	P.O. Box 129 Bordentown, N.J. 08505	Pit	Burlington.
Glen-Gery Corp	P.O. Box 1656 East Canton, Ohio 44730	Pit	Camden, Somerset.
New Jersey Shale Brick & Tile Corp.	P.O. Box 490 Somerville, N.J. 08876	Pit	Do.
The Rosehill Corp. t/a Oschwald Brick Works.	Cliffwood, N.J. 07721	Pit	Middlesex.
Greensand marl: Inversand Co.	226 Atlantic Avenue Clayton, N.J. 08312	Pit	Gloucester.

See footnote at end of table.

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[2] American Smelting and Refining Co. 1972 Annual Report, p. 13.

Table 6.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Gypsum, calcined:			
The Celotex Corp	1500 North Dale Mabry Tampa, Fla. 33607	Plant	Bergen.
The Flintkote Co., Building Products Group-East.	480 Central Ave. East Rutherford, N.J. 07073	do	Camden.
Kaiser Gypsum Co., Inc	Delanco, N.J. 08075	do	Burlington.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Do.
Ilmenite: Glidden-Durkee Division of SCM Corp.	P.O. Box 5 Lakehurst, N.J. 08733	Pit	Ocean.
Iron oxide pigments (manufactured):			
Cities Service Co	380 Madison Ave. New York, N.Y. 10017	Plant	Mercer, Middlesex.
E. I. du Pont de Nemours & Co., Inc.	Du Pont Building Wilmington, Del. 19898	do	Essex.
Lime: Limestone Products Corp. of America.	122 Main St. Newton, N.J. 07860	do	Sussex.
Magnesium compounds:			
J. T. Baker Chemical Co	600 North Broad St. Phillipsburg, N.J. 08865	do	Warren.
Northwest Magnesite Co	2 Gateway Center Pittsburgh, Pa. 15222	do	Cape May.
Peat:			
Hyper-Humus Co	Lafayette Rd. Newton, N.J. 07860	Bog	Sussex.
Kelsey Humus Co., Partac Peat Co.	Kelsey Park Great Meadows, N.J. 07838	Bog	Warren.
Mt. Bethel Humus Co., Inc.	1270 Broadway New York, N.Y. 10001	Bog	Sussex.
Netcong Natural Products	Lackawanna Drive Stanhope, N.J. 07874	Bog	Do.
Perlite (expanded):			
Coralux Perlite Corp. of New Jersey.	P.O. Box 251 Metuchen, N.J. 08840	Plant	Middlesex.
Grefco, Inc	630 Shatto Place Los Angeles, Calif. 90005	do	Do.
Zonolite Division, W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	do	Mercer.
Petroleum refineries:			
Chevron Oil Co	1200 State St. Perth Amboy, N.J. 08861	do	Middlesex.
Hess Oil & Chemical Corp.	State St. Perth Amboy, N.J. 08861	do	Do.
Humble Oil and Refining Co.	Box 22, Linden, N.J. 07036	do	Union,[1] Hudson.
Mobile Oil Corp.[1]	P.O. Box 927 Philadelphia, Pa. 19105	do	Gloucester.
Texaco Inc	135 East 42d St. New York, N.Y. 10017	do	Do.
Sand and gravel:			
Amico Sand & Gravel Co	Norman Ave. Riverside, N.J. 08075	Pit	Burlington.
Bennett Sand & Gravel Co., Inc.	Box 517 Manasquan, N.J. 08736	Pit	Monmouth.
S. Braen & Co	Brookside Wyckoff, N.J. 07481	2 pits	Bergen, Sussex.
Brick-Wall Corp	Route 70 Lakehurst, N.J. 08733	Pit	Ocean.
Fisher Bros. Sand & Gravel Co.	115 Hickory Lane Bayville, N.J. 08721	Pit	Do.
Houdaille Construction Materials, Inc.	10 Park Place Morristown, N.J. 07960	Pit	Morris, Ocean, Warren.
J. S. Morie & Sons, Inc	Box 35 Mouricetown, N.J. 08329	2 pits and 2 dredges.	Cumberland.
North Church Gravel Co., Inc.	Box 131A North Church Rd. Franklin, N.J. 07416	Plant	Sussex.
Penn Glass Sand Corp	Berkeley Springs, W. Va	Pit	Cumberland.
Saxon Falls Sand & Gravel Co.	R D 1 Stanhope, N.J. 07874	Pit	Morris.
N.J. Sillica Sand Co	Millville N.J. 08332	Pit	Cumberland.
Whitehead Brothers Co	60 Hanover Rd. Florham Park, N.J. 07932	Pit	Do.
Smelters (copper):			
American Metal Climax, Inc.	1270 Avenue of the Americas New York, N.Y. 10020	Plant	Middlesex.

See footnote at end of table.

Table 6.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Smelters (copper)—Continued			
American Smelting & Refining Co.	120 Broadway New York, N.Y. 10005	Plant	Middlesex.
The Anaconda Company	25 Broadway New York, N.Y. 10004	do	Do.
Stone:			
Granite, crushed and broken:			
Braen Industries, Inc.	Box 188 Wyckoff, N.J. 07481	Quarry	Morris.
Glen Gardner Quarry Corp.	Box 344 Glen Gardner, N.J. 08826	do	Hunterdon.
Hamburg Quarry, Inc.	Route 23 Hamburg, N.J. 07419	do	Sussex.
Passaic Crushed Stone Co., Inc.	Foot of Broad Pompton Lakes, N.J. 07442	do	Passaic.
Shahmoon Industries, Inc.	R.D. #1 Wharton, N.J. 07885	do	Morris.
Somerset Crushed Stone Division, Anthony Ferrante & Sons, Inc.	Route 202, Mine Brook Rd. Bernardsville, N.J. 07924	do	Hunterdon.
Tri County Asphalt Corp.	Beaufort Ave. Roseland, NJ. 07068	do	Sussex.
Limestone, crushed:			
Farber White Limestone Co.	Franklin, N.J. 07416	do	Do.
Limestone Products Corp. of America.	122 Main St. Newton, N.J. 07860	do	Do.
Sandstone, dimension: Delaware Quarries.	Lumberville, Pa. 18933	do	Hunterdon.
Traprock (basalt), crushed and broken:			
Samuel Braen's Sons	662 Goffle Rd. Hawthorne, N.J. 07500	do	Passaic.
Callanan Trap Rock Corp.	South Bethlehem, N.Y. 12161	do	Hudson.
Dock Watch Quarry Pit, Inc.	Box 245 Martinsville, N.J. 08836	do	Somerset.
Fanwood Crushed Stone Co.	141 Central Avenue Westfield, N.J. 07090	do	Do.
Houdaille Construction Materials, Inc.	10 Park Place Morristown, N.J. 07960	do	Hunterdon, Passaic, Somerset, Union.
M. L. Kernan Quarry	500 Tillon Rd. South Orange, N.J. 07079	do	Essex.
Orange Quarry Co.	318 Eagle Rock Ave. West Orange, N.J. 07050	do	Do.
Somerset Crushed Stone Division, Anthony Ferrante & Sons, Inc.	Route 202, Mine Brook Rd. Bernardsville, N.J. 07924	do	Somerset.
Trap Rock Industries, Inc.	Laurel Ave. Kingston, N.J. 08528	do	Hunterdon, Mercer, Somerset.
The Union Building & Construction Corp.	315 Howe Ave. Passaic, N.J. 07055	do	Passaic.
Warren Brothers Co., Sowerbutt-Standard District.	Planten Ave., Prospect Park Paterson, N.J. 07502	do	Do.
Sulfur (recovered): The Anlin Co. of New Jersey.	1200 State St. Perth Amboy, N.J. 08861	[1]Plant	Middlesex.
Vermiculite (exfoliated):			
Coralux Perlite Corp. of New Jersey.	P.O. Box 251 Metuchen, N.J. 08840	do	Do.
Vermiculite Industrial Corp.	308 Gilligan Ave. Port Newark, N.J. 07114	do	Essex.
Zonolite Division, W.R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	do	Mercer.

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[1] Also byproduct elemental sulfur.

The Mineral Industry of New Mexico

By Roman V. Sondermayer [1]

During 1972, New Mexico remained a significant supplier of minerals, mineral fuels, and related materials. Mineral production value totaled $1,097 million, an alltime high and 4.9% more than in 1971. The State ranked seventh among the 50 States in mineral production value and the industry comprised a major sector of the States economy. Fuels were first in value of production with $707.8 million, followed by metals and nonmetals with $265.8 million and $123.7 million, respectively. Among 36 minerals reported produced in the State, seven accounted for 94.6% of the

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[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in New Mexico [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays [2] .... thousand short tons..	76	$114	65	$108
Coal (bituminous) .... do....	8,175	26,657	8,248	29,794
Copper (recoverable content of ores, etc.).. short tons..	157,419	[r] 163,716	168,034	172,067
Gem stones	NA	65	NA	68
Gold (recoverable content of ores, etc.).. troy ounces..	10,681	441	14,897	878
Lead (recoverable content of ores, etc.).... short tons..	2,971	820	3,582	1,077
Lime .... thousand short tons..	35	W	28	W
Manganiferous ore (5% to 35% Mn) short tons, gross weight..	28,490	W	27,837	W
Mica, scrap .... thousand short tons..	W	W	14	W
Natural gas (marketed) .... million cubic feet..	1,167,577	175,137	1,216,061	225,420
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels..	9,952	28,465	10,338	29,970
LP gases .... do....	27,082	43,331	27,859	45,689
Peat .... thousand short tons..	1	W	2	46
Perlite .... do....	386	4,559	476	5,698
Petroleum (crude) .... thousand 42-gallon barrels..	118,412	402,602	110,525	376,778
Potassium salts. thousand short tons, K_2O equivalent..	2,291	86,689	2,296	91,115
Pumice .... thousand short tons..	287	601	311	809
Salt .... do....	146	1,130	W	W
Sand and gravel .... do....	8,869	7,975	7,600	8,553
Silver (recoverable content of ores, etc.) thousand troy ounces..	782	1,210	1,017	1,713
Stone .... thousand short tons..	[3] 2,913	[3] 5,337	2,768	5,499
Uranium (recoverable content U_3O_8) thousand pounds..	10,567	65,517	10,808	68,091
Zinc (recoverable content of ores, etc.)... short tons..	13,959	4,495	12,735	4,521
Value of items that cannot be disclosed:				
Carbon dioxide (natural), clay (fire), cement, fluorspar, helium (high-purity), gypsum, iron ore (usable), molybdenum, stone (dimension), vanadium, and values indicated by symbol W..	XX	27,424	XX	29,403
Total	XX	[r] 1,046,285	XX	1,097,292
Total 1967 constant dollars	XX	889,655	XX	[p] 912,837

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

[3] Excludes certain dimension stone; included with "Value of items that cannot be disclosed."

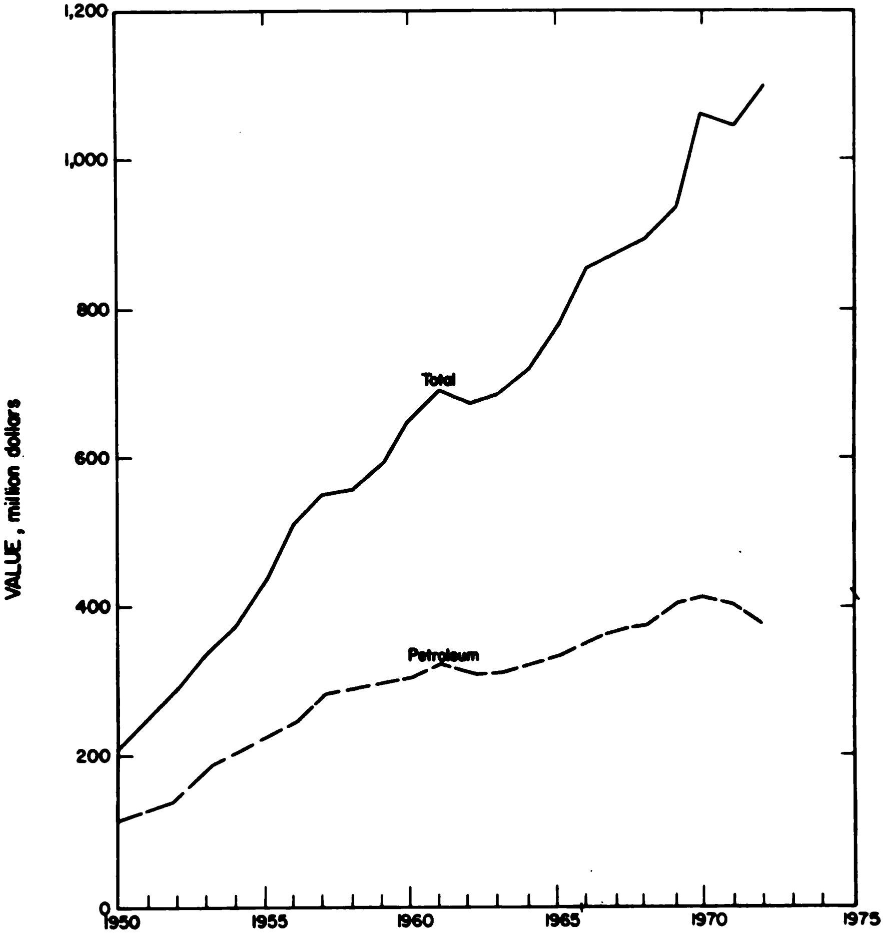

Figure 1.—Value of petroleum and total value of all mineral production in New Mexico.

total State mineral production value. These minerals ranked by value, with percentages showing individual share in the total, were as follows: Petroleum (34.3%), natural gas (20.5%), copper (15.7%), potassium salts (8.3%), natural gas liquids (6.9%), uranium (6.2%), and coal (2.7%).

New Mexico was the leading producer of uranium, perlite, and potassium salts in the United States. Furthermore, the State was among the leaders in output of copper, molybdenum, natural gas, natural gas liquids, pumice, and crude petroleum. Although there were mining operations throughout the State, most of the petroleum and natural gas was produced in the southeastern and northwestern parts. Copper output came from the southwestern corner of the State, uranium was mined and processed into yellow cake in the west-central part of the State, potash was mined in the southeast, and most of the perlite was produced in the north-central part of New Mexico.

Most of the mineral industry's products were consumed outside the State, making New Mexico a significant supplier of raw materials to other States.

Principal events in the mining industry of New Mexico during 1972 included the following: The beginning of construction

Table 2.—Value of mineral production in New Mexico, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Bernalillo	$11,802	$13,876	Cement, sand and gravel, stone, clays.
Catron	W	--	
Chaves	12.326	10,742	Petroleum, natural gas, sand and gravel, stone.
Colfax	W	10,667	Coal, stone, sand and gravel.
Curry	W	176	Stone.
De Baca	W	W	Sand and gravel.
Doña Ana	699	380	Sand and gravel, pumice, stone, clays.
Eddy	176,494	193,218	Potassium salts, petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Grant	168,929	173,521	Copper, zinc, silver, lead, molybdenum, gold, lime, manganiferous ore, stone, sand and gravel, fluorspar.
Guadalupe	W	W	Sand and gravel.
Harding	W	W	Natural carbon dioxide.
Hidalgo	1,575	2,173	Copper, gold, silver, clays, sand and gravel, zinc.
Lea	394,296	391,082	Petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Lincoln	W	W	Stone, iron ore.
Luna	204	314	Sand and gravel, molybdenum, stone, clays.
McKinley	71,304	72,777	Uranium, natural gas liquids, petroleum, coal, natural gas, stone, sand and gravel, clays.
Mora	W	W	Sand and gravel.
Otero	W	368	Sand and gravel, stone.
Quay	W	324	Sand and gravel.
Rio Arriba	36,563	43,666	Natural gas, petroleum, natural gas liquids, sand and gravel, stone, pumice.
Roosevelt	18,686	11,786	Petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Sandoval	2,336	8,544	Copper, sand and gravel, petroleum, gypsum, natural gas, silver, peat, pumice, clays, zinc.
San Juan	93,571	110,747	Natural gas, coal, petroleum, natural gas liquids, sand and gravel, stone, clays, pumice, uranium.
San Miguel	W	W	Stone, sand and gravel.
Santa Fe	2,045	1,750	Copper, sand and gravel, gypsum, stone, pumice, gold, silver, zinc.
Sierra	W	W	Sand and gravel, copper, gold, lead, silver, zinc.
Socorro	61	88	Copper, stone, sand and gravel, iron ore, silver.
Taos	21,105	21,842	Molybdenum, perlite, mica, sand and gravel, stone.
Torrance	W	W	Sand and gravel, stone.
Union	W	W	Stone, pumice, sand and gravel.
Valencia	22,477	26,504	Uranium, perlite, sand and gravel, stone.
Undistributed[2]	11,309	2,753	
Total[3]	1,046,285	1,097,292	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Los Alamos County is not listed because no production was reported.

[2] Includes some sand and gravel and stone which cannot be assigned to specific counties, gem stones, vanadium, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of New Mexico business activity

	1971	1972[p]	Change, percent
Employment and labor force, annual average:			
Total work force thousands	393.6	416.8	+5.9
Unemployment do	25.1	24.6	−2.0
Total nonagricultural employment do	305.9	328.5	+7.4
Mining do	16.7	16.3	−2.4
Construction do	19.6	24.1	+23.0
Manufacturing do	22.1	25.8	+16.7
Transportation and public utilities do	20.5	21.0	+2.4
Wholesale and retail trade do	65.7	71.2	+8.4
Finance, insurance, and real estate do	13.4	14.4	+7.5
Services do	55.5	60.1	+8.3
Government do	92.3	95.7	+3.7
Personal income:			
Total millions	$3,448	$3,894	+12.9
Per capita	$3,298	$3,656	+10.9
Construction activity:			
Total residential units authorized	12,239	14,977	+22.4
Value of nonresidential construction millions	$57.5	$93.1	+61.9
Cement shipments to and within New Mexico thousand short tons	522	582	+11.5
Mineral production value millions	$1,046.3	$1,097.3	+4.9

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

of a 100,000-ton-per-year copper smelter by Phelps Dodge Corp. near Animas, Hidalgo County, at a cost of $100 million; completion of the mine and mill capacity expansion to 90,000 tons of copper per year at the Tyrone mine of Phelps Dodge Corp.; continuation of surface installation construction and shaft sinking at the Church Rock, Section 35 mine of Kerr-McGee Corp.; continuation of preliminary work on coal gasification by El Paso Natural Gas Co. for the Burnham coal gasification

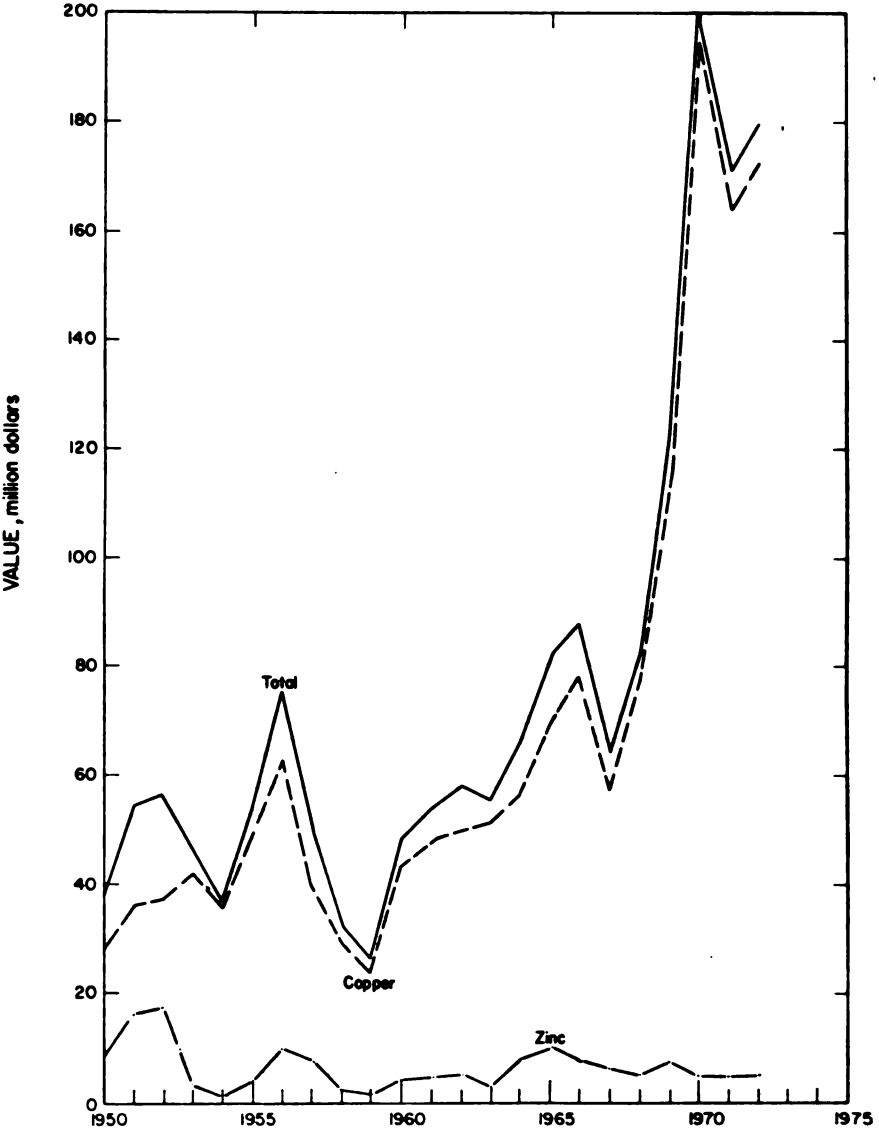

Fig. 2.—Value of mine production of copper, and zinc and total value of gold, silver, copper, lead, and zinc in New Mexico.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	492	248	122	959	--	36	37.56	NA
Metal	4,189	280	1,174	9,411	3	385	41.23	3,068
Nonmetal	2,108	340	716	5,732	4	166	29.66	6,427
Sand and gravel	936	194	181	1,534	--	41	26.73	1,290
Stone	268	214	57	461	--	12	26.06	1,018
Total[1]	7,993	282	2,251	18,096	7	640	35.75	NA
1972:[2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	4,005	280	1,123	9,025	3	312	34.90	4,821
Nonmetal	2,215	322	714	5,715	4	136	24.50	4,974
Sand and gravel	580	141	74	606	1	22	37.94	10,815
Stone	170	193	33	268	--	--	--	--
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data on file as of July 1, 1973 and are preliminary.

complex on the Navajo Indian Reservation, San Juan County; introduction of long wall mining in the York Canyon bituminous coal mine, Colfax County; stripping to confirm feasibility of large-scale strip mining in the general area of the York Canyon mine; announcement of plans for construction of a 30,000-barrel-per-day petroleum refinery in Lovington, Lea County; continuation of the decline of crude oil production; decline of reserves of crude oil and natural gas; and organization of an energy task force by the State of New Mexico.

Legislation and Government Programs.—Environment and energy were the focal points of government activities related to the mineral industry of New Mexico during 1972. The New Mexico Environmental Improvement Board issued a variety of new guidelines on emission control. The Board set standards on sulfur emission into the atmosphere for nonferrous smelters. According to regulations, no smelter may emit to the atmosphere more than 40 pounds of sulfur for every 100 pounds fed the smelter, or about 60% control. For new and remodeled smelters, the 90% control requirement is mandatory.

A surface mining reclamation bill was signed in February by the Governor. The legislation required land reclamation and revegetation as part of any coal strip mine operation.

The Governor of New Mexico appointed an Energy Study Task Force to survey the State's energy needs and energy reserves during the next 10 years.

The New Mexico Bureau of Mines and Mineral Resources received a grant of $24,800 from the Federal Bureau of Mines to continue studies of deep coal reserves in the Four Corners area. The State supplemented the funds by $8,110. The low sulfur content of this coal made it an important potential source of raw material for the manufacture of synthetic gas. In addition, the State received another grant from the Federal Bureau of Mines to study the use of bacteria for molybdenite leaching.

Papers relating to the mineral industry of the State were published by the U.S. Geological Survey[2] and the Federal Bureau of Mines.[3] In addition, the New Mexico State Bureau of Mines and Mineral Resources (a division of the New Mexico Institute of Mining and Technology) released three new publications.[4]

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[2] Hayes, P. T. Stratigraphic Nomenclature of Cambrian and Lower Ordovician Rocks of Easternmost Southern Arizona and Adjacent Westernmost New Mexico, U.S. Geol. Survey Bull. 1372–B, 1972, 21 pp.

Culbertson, J. K., C. H. Scot, and J. P. Bennett. Summary of Alluvial-Channel Data From Rio Grande Conveyance Channel, New Mexico, 1965–1969. U.S. Geol. Survey, Prof. Paper 526–J, 1972, 49 pp.

O'Sullivan, R. B., C. A. Repenning, E. C. Beaumant, and H. G. Page. Stratigraphy of the Cretaceous Rock and the Tertiary Ojo Alamo Sandstone, Navajo and Hopi Indian Reservation Arizona, New Mexico, and Utah. U.S. Geol. Survey Prof. Paper 521–E, 1972, 65 pp.

[3] Cardwell L. E., and L. F. Benton. Analyses of Natural Gases, 1971. BuMines IC 8554, 1972, 163 pp.

Deurbrouck, A. W. Washability Examinations of Core Samples of San Juan Basin Coals, New Mexico and Colorado. BuMines RI 7808, 1972, 26 pp.

U.S. Bureau of Mines. Analyses of Tipple and Delivered Samples of Coal (Collected During Fiscal Year 1971). RI 7588, 1972, 20 pp.

The number of mining and oil and gas leases on Federal lands in New Mexico decreased slightly to 15,300 leases comprising 10,660,778 acres, almost one-third of the Federal lands in the State and 13% of the total area of the State. Mining leases on Federal lands increased from 579 at yearend 1971 to 745 a year later. Acreage in mining leases decreased by 0.9% from 762,298 to 755,642 acres during 1972. Oil and gas leases increased 5.0% to 9,905,102 acres during 1972.

Employment and Injuries.—Final data for 1971 and preliminary data for 1972 on employment and injuries in the mineral industry of New Mexico, compiled by the Federal Bureau of Mines, are reported in table 4. The mineral fuels are excluded except for coal.

The mineral industry of New Mexico employed about 6.4% of the total labor force in the State. According to the 1972 Annual Report by the State Inspector of Mines, the breakdown of employment, by categories of activity, was as follows:

	Coal	Metals	Non-metals	Other	Total
Underground	184	1,457	581	--	2,222
Surface	459	1,857	1,628	--	3,944
Mill or plant	(1)	944	1,263	642	2,849
Other	(1)	459	308	--	767
Total	643	4,717	3,780	642	9,782

[1] Included in surface.

Employment in the petroleum- and gas-producing and refining industry was estimated to be about 15,600 persons.

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[4] McAnulty Sr. W., N. Winkler. Anticline Fluorspar, Hidalgo County. N. M. BuMines and Miner. Res., Target Exploration Rept. E-3, 1972, 10 pp.
McLeroy, D. F. Geochemical Background Values in Iron-Bearing Rocks of Rio Arriba County, New Mexico. N. Mex. BuMines and Miner. Res. Circ. 121, 1972, 20 pp.
Summers W. K., G. E. Schwab, and L. A. Brandvold. Ground-Water Characteristics in a Recharge Area, Magdalena Mountains, Socorro County, New Mexico. N. Mex. BuMines and Miner. Res. Circ. 124, 1972, 28 pp.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

New Mexico remained a major producer of mineral fuels and was a significant supplier of energy to other States during 1972.

The mineral fuels comprised 64.5% of the State's mineral output in terms of value. The share of petroleum and natural gas liquids decreased and amounted to $452.4 million, or 63.9% of the total value of fuels; natural gas (marketed) production contributed $225.4 million, or 31.8%; and coal was valued at $29.8 million, or 4.2%.

Although New Mexico ranked seventh in the United States in per capita consumption of energy, calorific value of mineral fuels production exceeded by far (approximately seven times) the State energy consumption. Petroleum (decreasing production) and natural gas and uranium (both registering modest increases in output) remained prominent sources of primary energy. Coal, with large reserves, was expected to regain significance when coal gasification projects become operational.

Calorific values of uranium and natural gas ranked first and second, respectively, among primary sources of energy produced in the State. The tabulation below shows details of calorific values of mineral fuels produced in New Mexico during 1971 and 1972:

	1971		1972	
	Quantity	10^{12} Btu [1]	Quantity	10^{12} Btu [1]
Coal .... thousand short tons	8,175	199	8,248	201
Crude oil .... thousand barrels	118,412	687	110,525	641
Natural gas liquids .... do	37,034	171	38,197	176
Natural gas .... million cubic feet	1,167,577	1,204	1,216,061	1,254
Uranium (U_3O_8) .... short tons	5,284	2,113	5,404	2,161
Total	XX	4,374	XX	4,433

XX Not applicable.
[1] The following factors were used to convert quantities to Btu: Bituminous coal and lignite, average 24,360,000 Btu per short ton; crude oil, 5,800,000 Btu per barrel; natural gas liquids, 4,620,000 Btu per barrel; natural gas, 1,031 Btu per cubic foot; uranium (U_3O_8), 400,000,000,000 Btu per short ton.

During 1971, the latest year for which complete data were available, consumption of energy in New Mexico showed natural gas to be the leading mineral fuel consumed in the State, with 49.4% of the total. Bituminous coal followed with 26.9%; petroleum refinery products added another 23.6%; and hydropower contributed only 0.1%. Although New Mexico was the largest producer of uranium in the United States, there was no direct consumption of uranium in the State. The State's gross energy input, by sectors, in trillion Btu[5] was as follows: Households 68.4, industry 160.8, transportation 126.8, generation of electric power 205.0, and miscellaneous 2.4. Per capita gross energy input was 54.6 million Btu.

Coal.—Continued strip mining, the introduction of long-wall mining in the York Canyon underground mine near Raton, Colfax County, and coal gasification were the principal events in the coal industry of the State. Coal production reached 8.2 million tons, an alltime high, during 1972. Value of output was $29,794,000, 11.8% more than in 1971. The average price continued to rise, reaching $3.61 per ton.

Five mines, one of which was an underground mine, were in operation. Coal mines employed a total of 643 persons, including 184 underground miners. Most of the coal was from the San Juan Basin in San Juan County. The electric power generating industry accounted for 99% of total State coal consumption.

The principal coal producer in the State was the Navajo strip mine of Utah International Inc., located southwest of Fruitland, San Juan County. The entire output of low-sulfur, high-ash coal from this mine was used at the Four Corners powerplant of the Arizona Public Service Co. Ash from the powerplant was returned to the mine for use as fill in reclaiming mined-out areas. The Four Corners powerplant experienced difficulties in operating its new electrostatic fly-ash precipitators. Output of plants four and five had to be reduced by 40% in the fall of 1972 because of high air pollution. The reduction in power output was reflected in lower demand for coal from the Navajo mine.

At the York Canyon mine, operated by Kaiser Steel Corp., long-wall mining was introduced utilizing equipment from the United Kingdom. Because of different underground conditions, the mine management partially replaced room-and-pillar mining with long-wall mining. Coal from the York Canyon mine was delivered by unit trains to Kaiser's steel plant at Fontana, Calif.

In the general area of the York Canyon mine, Kaiser started stripping to confirm the feasibility of a large-scale strip-mining operation. The mine, named West York Strip, may start production after evaluation of the results of the stripping operation. If the full-scale program was adopted, it would involve a capital expenditure of more than $5 million. The new open pit would increase production by 350,000 tons of coal per year. Removal of overburden was planned at a rate of 30 to 40 surface acres per year. Reclamation of the land to approved standards was scheduled to start almost immediately after removal of the coal.

Preliminary work on coal gasification continued during 1972. In November, El Paso Natural Gas Co. filed an application for authority to implement a coal gasification project in northwestern New Mexico, designed to produce 250,000 thousand cubic feet of synthetic pipeline gas (SPG) per day. El Paso's project, the Burnham coal gasification complex, would be located on a 40,287-acre coal lease in the Navajo Indian Reservation, San Juan County. Activities associated with the project will be conducted by two subsidiaries of El Paso: coal mining by Mesa Resource Co. and construction and operation of the coal gasification and related synthetic gas handling facilities by Fuel Conversion Co. Fuel Conversion Co. would purchase coal from Mesa, gasify it, and transport the resultant SPG through a proposed 23-mile pipeline from the Burnham complex to a point on El Paso's Southern Division transmission system. The estimated capital cost of the mine facilities is $67.5 million, while that of the coal gasification and related dehydration, compression, and pipeline facilities was estimated at $353.2 million. Based on projections of current cost levels, the cost of SPG to El Paso in the first year of operation was estimated at $1.21 per thousand cubic feet. This would increase the average cost of sales on El Paso's Southern Division by an estimated $0.061 per thousand cubic feet.

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[5] U.S. Department of the Interior. United States Energy Facts Sheet for 1971. 138 pp.

The coal would be gasified by the Lurgi process. A further methanation step would raise the Btu content of "town gas," a product of the conversion process, from about 415 Btu to about 972 Btu per cubic foot. A pilot plant, in operation in Kentucky since April 1972, should determine problems involved in operation of a large-scale methanation facility. Test operations of the plant reportedly confirmed all calculated and laboratory data.

The coal lease was jointly acquired by El Paso and Consolidation Coal Co. Exploration established more than 700 million tons of recoverable subbituminous coal reserves. The coal is covered with less than 150 feet of overburden. Recoverable reserves are sufficient to support three coal gasification complexes comparable in size to the proposed one. The Burnham complex would use about 225 million tons of coal over a projected 25-year life.

Surface mining would be followed by a large reclamation program including ash burial, spoil bank grading, and reseeding. At full production the mine should produce 8.8 million tons of coal annually, employ over 200 persons, and consume 8,145,700 kilowatt-hours per month of electricity and 707,500 gallons of water per day (about 10,000 acre-feet of water per year). Water for the project would be provided from the Navajo Reservoir, located on the San Juan River in San Juan and Rio Arriba Counties, N. Mex., and Archuleta County, Colo. A 40-mile-long underground pipeline would be constructed to move water to a storage reservoir near the site of the gasification project.

Environmental aspects of the project were extensively covered by El Paso. The beneficial environmental effects would include production and consumption of 250 million cubic feet per day of "clean" fuel, and the project would demonstrate that coal could be utilized with minimal environmental impact through commercial gasification. Although the Burnham gasification complex would incorporate modern pollution prevention devices and would comply with requirements for a clean environment, the project would cause emission of some materials into the atmosphere. Water use, surface mining, and relocation of some Indian families would be the major adverse effects of the project.

If all authorizations were obtained by the end of 1973, the Burnham gasification facility could start operations in late 1976, and full production could be attained in early 1977.

Eastern Gas & Fuel Associates of Boston, Mass., and Texas Eastern Transmission Corp. of Houston, Tex., bought 40,000 acres of low-sulfur coal lands in northwestern New Mexico. The new owners planned to use the coal for production of SPG.

Natural Gas.—Natural gas remained the principal primary source of energy (in Btu) consumed during 1972. Marketed output of 1,216,061 million cubic feet was slightly higher than that of 1971. San Juan, Lea, Eddy, and Rio Arriba Counties provided about 98% of marketed production. According to the New Mexico Oil Conservation Commission, at yearend there were 9,679 wells producing natural gas, 291 wells more than in 1971. As of yearend 1972, natural gas reserves were reported by the American Gas Association, Inc. (AGA) and by the American Petroleum Institute (API) at 12,335,647 million cubic feet, or about 5.6% less than in 1971. The 444 billion cubic feet of reserves added by revision and new field and pool discoveries was not sufficient to offset 1972 production. In the southeastern part of the State, reserves declined 7.2%, and in the northwestern part of the State the decline was about 4.8%.

During 1971, the latest year for which complete consumption data were available, about 269,368 million cubic feet of gas were consumed in New Mexico, or 49.4% of total Btu consumed in the State. Industry was the largest consumer, and accounted for about 141,725 million cubic feet; households followed with 49,385 million cubic feet; electric powerplants consumed about 49,163 million cubic feet; and transportation used approximately 29,095 million cubic feet.

Royalties and taxes received by the State from gas production amounted to $18.3 million, 24% above that of 1971. Taxes paid to the State and fee production of gas amounted to $13 million, up 30%. Twenty-seven gas exploratory wells were completed during 1972, an increase of 20 wells from the 1971 level. Eddy County led other counties in number of exploratory gas well completions, with 13 wells. Table 7 shows the most significant gas discoveries in the State.

El Paso Natural Gas Co. installed 13,500 additional compressor-horsepower at its San Juan Basin facilities during 1972, completing a 45,000-compressor-horsepower installation program started during 1971.

New pipeline construction was announced during 1972. Planning for a $10.3 million gas pipeline was completed from the northwestern part of New Mexico to near Hobbs in the southeast. The pipeline route begins at Kutz Canyon, near Bloomfield, and ends at a processing plant in Gaines County, Tex.

Natural Gas Liquids.—Production of natural gas liquids increased 3.1% to 38.2 million barrels, and about 5.4% in value. According to the New Mexico Oil and Gas Engineering Committee, a total of 1,093 billion cubic feet of gas was processed in 39 plants. After extraction of liquids, 960 billion cubic feet of gas was shipped to transmission companies, and 1.3 billion cubic feet was reinjected. Plant use, venting, and shrinkage accounted for 127 billion cubic feet, and the remainder was delivered directly to customers.

As of December 31, 1972, estimates made by the API and AGA indicated proved reserves of 503 million barrels of natural gas liquids,[6] a decline of 47 million barrels or about 8.6% from the 1971 estimate. Natural gas liquids reserves declined in both the northwestern and southeastern parts of the State.

Petroleum.—Although production declined during 1972, crude petroleum remained the largest single source of wealth in New Mexico. In addition, petroleum was the States principal source of tax revenue and the largest nongovernmental employer. The industry also provided significant nondestructive use of land and attracted large quantities of out-of-State capital. Consumption for refinery products accounted for only one-sixth of the total quantity of crude oil produced in New Mexico.

Output of crude petroleum totaled 110.5 million barrels, 7.9 million barrels (6.7%) less than in 1971. With a production value of $376,778,000, crude oil output ranked New Mexico fifth among producers in the United States. According to the State Oil Conservation Commission, 17,287 oil wells in 749 reservoirs were in production at yearend, an increase of 77 wells and 26 reservoirs. There were 2,727 injection wells in secondary-recovery or pressure-maintenance projects. The Permian basin in southeast New Mexico remained the principal oil-producing area, accounting for about 92% of the total. Direct revenue to the State from petroleum production in 1972 totaled $43.3 million, a decrease of 8.1%. Royalties amounted to $21.5 million with the balance divided among school, severance, conservation, and ad valorem taxes.

Table 5.—New Mexico: Production of crude oil and condensate, and natural gas, by county

County	Crude oil and condensate (thousand 42-gallon barrels)		Natural gas (million cubic feet)	
	1971	1972	1971	1972
Southwest New Mexico:				
Chaves	2,974	2,304	13,412	12,860
Eddy	18,930	19,194	136,479	168,117
Lea	83,479	78,127	433,482	419,343
Roosevelt	4,214	2,295	16,313	11,115
Subtotal	109,597	101,920	599,686	611,435
Northwest New Mexico:				
McKinley	1,754	1,853	872	1,570
Rio Arriba	2,038	1,895	183,841	185,025
San Juan	4,924	4,619	381,638	398,420
Sandoval	99	238	1,540	1,319
Subtotal	8,815	8,605	567,891	586,334
Total New Mexico	118,412	110,525	1,167,577	[1] 1,197,769

[1] Total for natural gas in 1972 differs from same total in table 1. U.S. Bureau of Mines and the State of New Mexico use different pressure basis for natural gas statistics.

Source: New Mexico Oil Conservation Commission. 1972 Oil and Gas Statistics.

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[6] American Gas Association, Inc., American Petroleum Institute, and Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids and Natural Gas in the United States and Canada as of Dec. 31, 1972. V. 27, May 1973, p. 248.

As reported by the API, proved reserves of crude oil declined 11.2% to 583.6 million barrels at yearend. Additions to reserves from new fields and pools totaled 3,888,000 barrels; extensions and revisions added another 28.3 million barrels. An additional 121.1 million barrels of indicated reserves were estimated in known reservoirs, based on additional recoveries in excess of proved reserves, which engineering knowledge and judgment indicate would be economically possible by application of fluid injection, whether or not such programs are currently in effect.

Based on API data, overall drilling activity in the State totaled 1,034 wells, and 5,750,873 feet, an increase of 218 wells and 1,406,743 feet compared with the 1971 figures. The number of exploratory wells increased from 129 in 1971 to 216 in 1972. The success ratio for wildcat drilling was 18.9%, about 8.9% above results reported in 1971. For development drilling, the success ratio was 85.5%, an increase of 2% from the 83.6% in 1971. During 1971, Eddy County with 13 new gas discoveries, Lea County with three oil and five gas discoveries, and Roosevelt County with five new oil discoveries were the areas of most successful exploratory drilling.

Shell Pipe Line Corp. started construction of a new 46-mile, 6-inch crude oil pipeline in northwestern New Mexico. This pipeline will have an initial capacity of about 7,000 barrels per day and will extend from the Hospah station of the Shell pipeline to the Shell Oil Co. Ciniza refinery near Gallup. Estimated cost was about $1.3 million. Completion of the project was planned for early 1973. According to Shell, the new pipeline will transport oil from increased production at the Hospah field. The Ciniza refinery will process crude from the new line without expansion of facilities.

Six petroleum refineries were in operation: Caribou Four Corners Oil Co., at Kirkland, San Juan County; Famariss Oil and Refining Co. at Monument, Lea County; Navajo Refining Co. at Artesia, Eddy County; Plateau Inc. at Bloomfield, Lea County; Shell Oil Co. at Ciniza, McKinley County; and Thriftway Oil Co. at Bloomfield, San Juan County. Aggregate ouput capacity was 48,400 barrels per day.

Famariss Oil and Refining Co. announced plans to build a $30 million refinery complex near Lovington, Lea County. The new refinery would be the largest in the State and have a capacity of 30,000 barrels per day. It would be supplied exclusively by Lea County oil.

Runs of crude oil to stills totaled 16.3 million barrels, about 92% of operating crude oil throughput capacity. All crude oil for refinery throughput was produced within the State. Out-of-State shipments of crude oil produced in New Mexico totaled 95.5 million barrels, a decrease of 8.7% compared with 1971. Texas received 59.6

Table 6.—New Mexico: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Chaves	12	2	14	3	3	31	65	286,535
Colfax	--	--	--	--	--	1	1	4,965
Curry	--	--	--	--	--	1	1	7,346
De Baca	--	--	--	--	--	2	2	2,814
Eddy	131	31	17	--	13	31	223	1,177,623
Guadalupe	--	--	--	--	--	2	2	2,818
Harding	--	--	--	--	2	1	3	5,404
Lea	280	5	44	3	5	21	358	2,572,948
Luna	7	--	7	2	--	36	52	149,973
Mora	--	--	--	--	--	3	3	15,480
Otero	--	--	--	--	--	1	1	1,545
Quay	20	71	4	--	1	2	98	612,499
Rio Arriba	9	1	5	--	2	11	28	187,900
Roosevelt	5	1	3	5	--	3	17	93,543
Sandoval	24	100	25	1	--	25	175	610,248
San Juan	--	--	--	--	--	2	2	9,938
Sierra	--	--	--	--	--	1	1	1,895
Torrance	--	--	--	--	1	1	2	7,399
Total	488	211	119	14	27	175	1,034	5,750,873

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 7.—New Mexico: Principal oil and gas discoveries in 1972

County and field	Well	Operator	Location			Producing formation	Total depth (feet)	Initial production	
			Section	Township	Range			Barrels of oil per day	Thousand cubic feet of gas per day
Eddy:									
Unnamed	No. 1—Cedar Canyon.	Skelly	9	24 S	29 E	Morrow	15,000	--	32,900
Do	No. 1—Burton Flat.	Monsanto	3	21 S	27 E	do	11,700	--	37,700
McKinley:									
Unnamed	No. 1—Blackeye.	H.S. Birdseye.	29	20 N	9 W	Dakota	3,900	55	--
Do	No. 1—Peperthin.	Eastern Petroleum.	26	19 N	5 W	Mancos	4,249	71	--
Do	No. 55-4—Jaco-Slaughter.	Jaco, Inc.	32	20 N	9 W	Menefee	1,057	119	--
Rio Arriba: Basin.	No. 1—La Jara.	J. P. McHugh.	25	29 N	3 W	Gallup	8,300	--	983
Roosevelt: Peterson.	No. 1—Peterson.	Amoco	19	5 S	33 E	Cisco	7,936	--	7,766
Sandoval:									
Unnamed	No. 1—Quinella	Tesoro Petroleum.	31	23 N	6 W	Gallup	6,698	52	--
Do	No. 1—Crosswise.	do	31	23 N	2 W	Dakota	7,435	32	--
Venado	No. 1-7—Jair	Apache Corp.	7	22 N	5 W	Menefee	5,500	220	--
Parlay	No. 2—Parlay	Tesoro Petroleum.	29	22 N	3 W	do	4,374	306	--
San Juan:									
Lone Mountain Creek.	No. 1—Navajo Tract 21.	Zoller Dennenberg.	7	42 S	25 E	Desert Creek.	5,646	350	--
Unnamed	No. 2	Dugan Production.	36	28 N	15 W	Pictured Cliffs.	800	--	130

million barrels; Illinois, 17.3 million barrels; Indiana, 10.6 million barrels; and Missouri and Nebraska, 3.2 million barrels. The rest went to Ohio, Kansas, Oklahoma, Utah, and California.

METALS

The value of metal production increased to $265.8 million, 4.5% greater than the $254.3 million in 1971. Higher production of copper, gold, silver, lead, and uranium accounted for the increase. Value of copper production accounted for 64.7% of total metal value in the State. The uranium share was an additional 25.6%. New Mexico also recorded production of iron ore, manganiferous ore, molybdenum, vanadium, and zinc.

Copper.—During 1972 mine production of copper was the highest recorded in the history of New Mexico. The State ranked third, after Arizona and Utah. Completion of expansion at the Tyrone mine, operated by Phelps Dodge Corp., accounted for most of the additional copper output. There were 14 mines producing copper, and Grant County, with nine mines, again was the leading county. The Chino mine near Santa Rita, Grant County, operated by Kennecott Copper Corp., and the Tyrone mine near Tyrone, Grant County, operated by Phelps Dodge Corp., were the leading copper-producing facilities in the State. Tables 8, 9, and 10 show details of copper production in the State.

Principal events in the copper industry included the beginning of construction of the Phelps Dodge Corp. 100,000-ton-per-year copper smelter near Animas, Hidalgo County, and the initial implementation of an environmental program at the Hurley smelter of Kennecott Copper Corp. in Grant County.

Table 8.—New Mexico: Mine production of gold, silver, copper, lead, and zinc in 1972, by type of material processed and method of recovery, in terms of recoverable metal

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Acid leaching (heap)	--	--	338	--	--
Smelting of concentrates	11,518	1,004,227	140,087	3,572	12,732
Direct smelting of:—					
Cleanup	--	180	29	--	--
Ore	3,379	12,473	63	10	3
Precipitates	--	--	27,572	--	--
Total	3,379	12,653	27,664	10	3
Grand total	14,897	1,016,880	168,034	3,582	12,735

Table 9.—New Mexico: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing [1]	Material sold or treated (short tons)	Gold		Silver	
	Lode		Troy ounces	Value	Troy ounces	Value
1970, total	19	[r] 20,797,211	8,719	$317,285	781,952	$1,384,697
1971, total	13	[r] 18,554,543	10,681	440,593	782,441	1,209,653
1972:						
Grant	9	18,978,847	11,883	696,344	884,649	1,490,633
Hidalgo	1	100,866	1,821	106,711	83,730	56,835
Santa Fe	1	34,352	1,192	69,851	21,124	35,594
Undistributed [2]	3	1,161,795	1	59	77,377	130,379
Total	14	20,270,860	14,897	872,965	1,016,880	1,718,441

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1970, total	166,278	$191,884,984	3,550	$1,108,979	16,601	$5,086,306	$199,782,251
1971, total	157,419	163,715,604	2,971	819,940	13,959	4,494,815	170,680,605
1972:							
Grant	159,952	163,791,145	3,581	1,076,458	12,731	4,519,521	171,574,101
Hidalgo	1,948	1,994,854	--	--	2	681	2,159,081
Santa Fe	786	805,016	--	--	1	268	910,729
Undistributed [2]	5,348	5,476,392	(3)	144	2	614	5,607,588
Total [4]	168,034	172,067,407	3,582	1,076,602	12,735	4,521,084	180,251,499

[r] Revised.
[1] Operations at plants leaching runoff water, not counted as producing mines.
[2] Includes Sandoval, Sierra, and Socorro Counties, combined to avoid disclosing individual company confidential data.
[3] Less than ½ unit.
[4] Data may not add to totals shown because of independent rounding.

Construction of the Phelps Dodge smelter, located 11 miles east and 16 miles south of Animas, started in August 1972. The smelter will use the flash-smelting process developed by Outokumpu Oy of Finland. The plant was designed to produce 280 tons per day of 750-pound copper anodes containing 99% copper. About 475,000 tons of concentrate per year from the Tyrone mine will be fed to the smelter. Copper anodes will be shipped to the Phelps Dodge refinery at El Paso, Tex. Total cost for the smelter was reported to be near $100 million. As the smelter was planned from the start to minimize environment impact, approximately 60% of total costs will be for pollution control. Employment was to be 300 persons with an annual payroll of $4 million.

Phelps Dodge copper mine expansion was completed in August 1972. Total costs amounted to $38 million, and the capacities of mine and concentrator were increased to 90,000 tons of copper per year.

Table 10.—New Mexico: Mine production of gold, silver, copper, lead, and zinc in 1972, by class of ore or other source material, in terms of recoverable metal

Source	Number of mines[1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Gold and silver [2]	3	45,296	3,379	12,048	21	10	3
Copper	7	20,051,805	11,351	840,879	139,872	--	311
Lead-zinc	1	138,273	167	163,773	541	3,571	12,421
Total	8	20,190,078	11,518	1,004,652	140,413	3,571	12,732
Other lode material:							
Cleanup	--	181	--	180	29	--	--
Copper precipitates	9	35,305	--	--	27,572	--	--
Total	9	35,486	--	180	27,601	--	--
Grand total [3]	14	20,270,860	14,897	1,016,880	168,034	3,582	12,735

[1] Detail may not add to total because some mines produce more than one class of material.
[2] Combined to avoid disclosing individual company confidential data.
[3] Data may not add to totals shown because of independent rounding.

At the Hurley smelter, Grant County, Chino Mines Division of Kennecott Copper Corp. started a $21 million air pollution control program. A contract was awarded for construction of a 600-ton-per-day acid plant as a part of this program. Furthermore, Kennecott Copper Corp. intended to convert a gas collection facility at Hurley to meet Federal primary ambient air quality standards and State sulfur oxide emission regulations. A contract for the construction of a converter gas collection system was awarded. The collection system project will include installation of water-cooled hoods on the four converters, new gas-cooling devices, and new individual flues to each converter. An electrostatic precipitator will also be constructed to remove dust particles from smelter emissions. In addition, about $2.5 million was planned for construction of a neutralization plant for excess sulfuric acid. The company expects that the overall environmental project will be operational in mid-1974.

American Smelting and Refining Co. (ASARCO) started feasibility studies on possible construction of an electrolytic copper refinery southwest of Las Cruces, Doña Ana County. ASARCO also obtained an option on approximately 32,000 acres of land about 12 miles southwest of Las Cruces for the proposed refinery. However, no bids for the land were received at a public sale held December 20 by the New Mexico State Land Office.

Earth Resources Co. stated in its annual report that it had completed a program to treat oxide as well as sulfide ores in the concentrator at the company's Naciamento copper mine near Cuba, Sandoval County. As a result of plant modifications, the minable reserves at Naciamento were increased by 3 million tons of oxide ore containing more than 35 million pounds of copper. At the same time, concentrator capacity was expanded by one-third to 4,000 tons of ore per day. The recovery of copper from oxide ore averages more than 70%.

Gold.—Output of gold was from 14 operations, mostly as a byproduct of copper mining in Grant, Hidalgo, Santa Fe, Sandoval, Sierra, and Socorro Counties. Value of gold output almost doubled during 1972, reflecting the increase in the price of gold on the free market.

Iron Ore.—Modest quantities of magnetite ore produced in the State were consumed at local cement plants. The Ancho Rico plant in Lincoln County was the largest producer. In addition, the Continental copper mine in Grant County, operated by UV Industries, Inc., produced magnetite as a byproduct. Underground copper ore contains from 22% to 23% magnetite, and the surface ore runs from 17% to 19%. The mill extracted 70% of the magnetite in the ore and produced a 60% Fe magnetite concentrate from about 3,000 tons of ore per day. Another mill, with a capacity of 5,000 tons per day, will be operational in early 1974.

Lead and Zinc.—The Groundhog mine in Grant County, operated by ASARCO, remained the only significant lead and zinc producer in the State. In addition, small quantities of zinc were produced in Hidalgo and Santa Fe Counties.

According to ASARCO's annual report for 1972, mining commenced on new Groundhog ore bodies, which were leased in 1971, consequently output of lead increased. Zinc output, however, was below that of 1971, apparently reflecting different composition of ores in sections mined during 1972. Groundhog mine output of lead was reported at 3,800 short tons and zinc at 14,000 short tons.[7]

Hydro Nuclear Corp. of Albuquerque announced the acquisition of exploration and mining rights to the Linchburg mine and related claims near Magdalena, Socorro County, from New Jersey Zinc Co. The Linchburg mine was first opened in 1910 and produced lead and zinc ores almost continuously until 1969. Hydro Nuclear estimated minimum reserves of 150,000 tons of commercial-grade lead and zinc ores, also containing copper, silver, gold, and cadmium. The principal ore body lies west of and against the Linchburg fault zone. Ore occurs as replacement in the Kelly Limestone and exhibits a marked relation to faults and fractures. The ore body is made up of a number of high-grade ore shoots, apparently localized by faults and connected by lower grade mineralization in the intervening areas. Hydro Nuclear was also considering moving a flotation mill, currently located in Battle Mountain, Nev., to the Linchburg area. An output of about 3,500 tons of ore per month was anticipated, and an increase to 4,500 tons per month was planned. In addition, on August 1, 1972, Hydro Nuclear announced discovery of commercial lead, zinc, and copper mineralization on its Vindicators properties near Magdalena, Socorro County. Preliminary exploration drilling showed more than 100 feet of continuous mineralization at a depth of less than 500 feet. Further exploratory drilling was necessary to fully define the ore body.

Molybdenum.—During 1972 molybdenum was produced at the Questa mine, Taos County, molybdenum was also produced as a byproduct at the Chino copper mine in Grant County and was also recovered during uranium beneficiation at Kerr-McGee Corp.'s Ambrosia Lake installation.

Molybdenum Corp. of America (Molycorp) was examining the possibility of closing the Questa mine by 1976. A combination of low molybdenum prices and increasing production costs could cause the closing, even though there are sufficient proven ore reserves for operation through 1986.

Silver.—During 1972 silver production and values showed increases of 30% and 42%, respectively, over 1971 figures. Most of the silver was a byproduct of copper, lead, and zinc mining, where larger base metal production resulted in increased silver output. The largest producer of silver was the Tyrone mine, operated by Phelps Dodge Corp., followed by Kennecott Copper Corp.'s Chino mine.

Uranium.—During 1972 New Mexico remained the leading producer of uranium in the United States, accounting for 43% of the U.S. total. The shippers produced 10,808,000 pounds of recoverable uranium oxide (U_3O_8) valued at $68,090,883, from 39 mining operations in three counties. Quantity and value of uranium output increased 2.3% and 3.9%, respectively. The Atomic Energy Commission (AEC) reported three uranium processing mills in New Mexico having a nominal capacity of 13,500 tons of ore per day. These mills, all located in the general area of Grant and Valencia Counties, comprised 42.3% of total U.S. uranium mill capacity expressed in tons per day for mills in operation or under construction. The uranium industry (excluding exploration) employed a total of 2,198 persons of whom 1,655 worked in mines and 543 in uranium mills.[8]

Surface exploration and development drilling increased from 3.0 million feet in 1971 to 3.3 million feet in 1972. New Mexico ranked second, after Wyoming, in footage drilled for uranium in the United States. Acreage held for uranium mining and exploration decreased from 4.1 million acres in 1971 to 3.1 million acres. Five producers—Kerr-McGee Corp. The Anaconda Company, United Nuclear-Homestead Partners, United Nuclear Corp., and Homestake Mining Co.—accounted for 99.2% of the total value of uranium production during the year.

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[7] American Smelting and Refining Co. Annual Report. 1972, 24 pp.

[8] Atomic Energy Commission, Grand Junction Office. Statistical Data of the Uranium Industry. Jan. 1, 1973, 65 pp.

According to Anaconda's annual report, the Jackpile-Paguate uranium mine and the Bluewater uranium mill remained the company's principal activities in New Mexico. Underground mining at the Jackpile-Paguate mine was planned to start in 1973 in combination with continued open pit operations. The mill at Bluewater will be expanded approximately 50%, which would provide desired flexibility for treatment of larger quantities of lower grade ores. Because of delays in construction of nuclear powerplants, Anaconda deliveries of uranium oxide were reduced to 3,121,000 pounds, 11.5% lower than in 1971. Deferred deliveries were scheduled for 1973 and 1974.

Construction of surface installations for Kerr-McGee's Church Rock Section 35 mine, located on the Navajo Reservation 14 miles northeast of Gallup, McKinley County, was about 90% completed at yearend. The shaft, a 14-foot-diameter, three-compartment unit, was completed to a depth of 1,550 feet. Plans called for a total shaft depth of 1,800 feet. Mine development operations were scheduled for late 1973, and production was expected in early 1975. Ore will be trucked to the Kerr-McGee Ambrosia Lake mill. In full production, the mine will employ about 150 persons, most of whom will be Navajo Indians. In addition to developing its Church Rock property, the company was active in exploratory drilling for uranium in the same area. The mill at Ambrosia Lake, with a capacity of 7,000 tons of ore per day, operated at less than capacity during the year. Mill throughput was reduced to lower rates to correlate production with sales requirements.

Production of United Nuclear-Homestake Partners in the Ambrosia Lake area decreased about 51% compared with 1971 output. Mill production for account of the partnership also declined and was 35% lower than in 1971. Uranium was mined from four mines during the year. New ore areas of significant size were developed in two of the mines. Leach production of U_3O_8 from the mines was increased to a point at which this process is a significant factor in production.

Ranchers Exploration & Development Corp., Occidental Minerals Corp., and Frontier Mining Corp. organized a joint exploration venture in March. Ranchers managed the venture and held a 45% interest; Occidental and Frontier each held a 27.5% interest. Exploration was financed by Occidental and Frontier. The venture agreement called for yearly expenditures of at least $500,000 for 2 years. Funds for development, construction, and other expenses would be contributed by the three partners in accordance with their ownership interest. The venture held 120,000 acres in the Grants mineral belt.

Ranchers and HNG Oil Co., a subsidiary of Houston Natural Gas Corp. have decided to develop their jointly held Section 7 uranium mine at Ambrosia Lake. Future sales of uranium to Gulf Oil Corp., from this mine, were assured with an agreement concluded during 1972. This agreement called for delivery of a minimum of 5 million pounds U_3O_8 to a maximum of 10 million pounds U_3O_8. The actual sales total would depend on ultimate production from the property and from adjoining properties held under lease. Deliveries will start in 1976 at an annual rate of 1 million pounds U_3O_8. A vertical 14-foot-diameter shaft will be sunk to 1,480 feet by conventional methods. Furthermore, the contractor will develop pumping stations at depths of 925 and 1,245 feet, and the main mining station at 1,280 feet. Work was scheduled to commence in February 1973 and should be completed in 17 months. At yearend, site preparation was underway, and a 90-foot head frame and hoist were installed. Ore will be processed at the Kerr-McGee mill under a toll processing agreement. In addition, Ranchers leased or obtained options to lease a large acreage in New Mexico and Arizona, including 16,766 acres in the western part of the Grant mining belt, McKinley County, which supplements the acreage where the Rancher-Occidental-Frontier joint venture team has been exploring since spring 1972.

Oklahoma Natural Development Corp. and Reserve Oil & Minerals Corp. abandoned their uranium exploration program in the Laguna Indian lands in Valencia County. About 130 drill holes failed to disclose commercial deposits of uranium-bearing minerals.

NONMETALS

Value of nonmetals production increased 7.1% to $123.7 million, and represented almost 11.3% of the State's total value of mineral production. Potassium salts remained the most valuable nonmetallic mineral produced in New Mexico; its share in the value of total nonmetals output was 73.6%.

Cement.—The State's only cement plant was located at Tijeras, east of Albuquerque, Bernalillo County, and was operated by Ideal Cement Co., a division of Ideal Basic Industries, Inc. Consumption of portland cement, 565,805 short tons, was 11.3% more than in 1971.

Fluorspar.—Only one fluorspar facility, that of Southwest Fluorspar Co., was in operation during the year. The Annual Report of the State Mine Inspector for 1972 recorded five new fluorspar mine registrations. At the Chise mine (which was in the development stage), a new 100-ton-per-day fluorspar mill started trial production. The operating company, Win Industries, Inc., estimated reserves of more than 1 million tons of acid-grade fluorspar.

Silver Monument Minerals of Dallas, Tex., took an option to acquire fluorspar claims covering some 800 acres in the Wilcos mining district of Catron County. Drilling indicated substantial near-surface deposits of fluorspar.

Gypsum.—White Mesa Gypsum Co., Republic Gypsum Co., and Duke City Gravel Products Co. mined crude gypsum in Santa Fe and Sandoval Counties.

Republic Gypsum Co. leased a former Kaiser gypsum plant in Rosario, Sandoval County. Kaiser had closed that 10-year-old plant in December 1970. At yearend the Rosario plant was operating at full capacity of 90 million feet of gypsum board per year.

Facilities at American Gypsum Co. were under expansion. Gypsum for the plant came from deposits near San Ysidro, Sandoval County.

Mica.—A mica mine in Taos County and a mica mill in Santa Fe County were active during 1972. Both facilities were operated by Mineral Industries Commodities of America, Inc. Toward yearend, a new mica mine and mill were ready to go on stream at La Madera, Rio Arriba County, near Ojo Caliente, which is 26 miles north of Espanola. Mica reserves were reported at 10 million tons. Output was planned at a value level of $1.5 million per year. When in full operation, the mine and mill will employ a total of 45 persons. Rio Arriba Minerals Co., a wholly owned subsidiary of Western Energy Corp. of Santa Fe, was the operator.

Perlite.—New Mexico continued to lead the Nation with 87% of total crude perlite production. The State produced 475,775 tons of perlite valued at $5.7 million, a significant increase compared with 1971. Grefco, Inc., with the El Grande mine, and Johns-Manville Perlite Corp. with the Seven Hill mine, both in Taos County, accounted for about 84% of total output. Remaining production came from operations of Silbrico Corp. in Taos County and United States Gypsum Co. in Valencia County.

Grefco, Inc., started installing a new air pollution control system at its mine. In late summer, the project was delayed because of equipment delivery problems. The new installation will control perlite dust as well as emissions from stacks.

Potash.—New Mexico remained the leading producer of potash in the Nation, contributing about 86% of total U.S. output in 1972. There were seven companies engaged in potash production, all in Eddy County, southeastern New Mexico. Production remained at the same level as in 1971. However, value of production increased substantially compared with that of 1971. Potash Co. of America and Kerr-McGee Corp. remained the most significant producers.

United States Potash and Chemical Co. came under the ownership of Teledyne, Inc., and has been renamed Teledyne Potash Co. Officials of the new company announced major new construction totaling $10 million. Initially, $3 million was to be spent in 1973, and over $0.5 million was invested in new mining equipment during 1972. Plans also included a new flotation and crystallization plant, located 17 miles from the mine site.

Pumice.—New Mexico ranked fifth by quantity in the Nation in the production of pumice.[9] During 1972 the quantity sold or used in the State amounted to 310,539 short tons, 8.4% more than in 1971. Value reached $809,329, 34.6% more than in

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[9] Statistics designated "pumice" also include such volcanic materials as scoria and volcanic cinders.

Table 11.—New Mexico: Crude potassium salts produced, and marketable salts produced and sold or used

(Thousand short tons and thousand dollars)

Period	Crude salts[1] (mine production)		Marketable potassium salts					
			Production			Sold or used		
	Gross weight	K_2O equivalent	Gross weight	K_2O equivalent	Value[2]	Gross weight	K_2O equivalent	Value
1971:								
January-June	8,298	1,453	2,136	1,210	46,195	2,484	1,404	54,462
July-December	7,824	1,338	1,894	1,081	40,494	1,617	914	34,863
Total[3]	16,117	2,792	4,030	2,291	86,689	4,101	2,317	89,325
1972:								
January-June	8,718	1,460	2,128	1,187	47,018	2,336	1,294	51,400
July-December	8,567	1,411	1,994	1,108	44,097	1,753	991	38,461
Total[3]	17,285	2,871	4,122	2,296	91,115	4,089	2,285	89,861

[1] Sylvite and langbeinite.
[2] Derived from reported value of "Sold or used."
[3] Data may not add to totals shown because of independent rounding.

Table 12.—New Mexico: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,138	1,503	1,495	2,124
Fill	268	136	208	135
Paving	441	452	323	325
Other uses[1]	116	134	([2])	([2])
Total[3]	1,964	2,225	2,027	2,584
Gravel:				
Building	1,592	2,249	1,879	2,572
Fill	345	65	56	42
Paving	3,616	1,778	1,449	1,580
Miscellaneous	W	W	198	116
Other uses	55	57	([4])	([4])
Total[3]	5,609	4,150	3,582	4,310
Government-and-contractor operations:				
Sand:				
Fill	28	27	64	30
Paving	91	95	67	99
Other uses	2	1	4	5
Total	121	123	135	134
Gravel:				
Fill	373	191	1,582	1,299
Paving	769	1,253	225	186
Other uses	34	33	48	41
Total[3]	1,175	1,479	1,856	1,526
Total sand and gravel[3]	8,869	7,975	7,600	8,553

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes other industrial sand (1971).
[2] Included with fill to avoid disclosing individual company confidential data.
[3] Data may not add to totals shown because of independent rounding.
[4] Less than ½ unit.

1971. There were nine pumice-producing operations in six counties. Twin Mountain Rock Co. in Union County, General Pumice Corp. in Rio Arriba County, and Morton Bros. in Doña Ana County were the largest producers.

Table 13.—New Mexico: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Bernalillo	14	2,606	2,280	12	2,523	2,915
Catron	1	42	84	--	--	--
Chaves	6	166	162	6	257	252
Curry	1	35	35	--	--	--
Doña Ana	11	941	526	8	339	206
Grant	3	197	267	2	W	W
Guadalupe	3	W	166	2	W	W
Lea	5	333	461	5	269	451
Lincoln	1	13	6	--	--	--
Luna	4	164	W	3	W	W
McKinley	4	261	141	1	4	6
Otero	7	290	88	7	190	238
Quay	2	27	42	3	179	324
Rio Arriba	7	387	399	8	417	377
Roosevelt	1	W	W	1	64	64
Sandoval	3	W	W	3	1,522	1,280
San Juan	9	433	584	9	362	473
Santa Fe	10	1,079	1,351	4	W	W
Sierra	5	W	45	5	42	38
Socorro	3	113	33	1	W	W
Taos	6	70	79	5	77	106
Valencia	4	97	86	5	W	W
Undistributed [1]	[r] 19	1,615	1,142	13	1,354	1,825
Total [2]	129	8,869	7,975	103	7,600	8,553

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Colfax (1972), De Baca, Eddy, Harding (1971), Hidalgo, Mora, San Miguel, Torrence, and Union Counties and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 14.—New Mexico: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972			Kind of stone produced in 1972
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Bernalillo	3	729	W	2	W	W	Limestone, other stone.
Chaves	2	34	W	3	114	W	Do.
Colfax	1	W	W	1	4	4	Other stone.
Curry	3	W	W	2	77	176	Do.
Doña Ana	1	W	2	2	W	15	Do.
Eddy	3	164	306	3	W	W	Limestone.
Grant	1	82	W	1	81	W	Do.
Lea	4	569	959	5	W	W	Other stone.
Lincoln	2	W	W	3	211	450	Limestone.
Otero	3	W	W	2	81	125	Do.
Roosevelt	--	--	--	1	58	66	Other stone.
San Juan	2	W	W	3	32	34	Traprock.
San Miguel	1	W	W	1	135	190	Quartzite, other stone.
Taos	1	W	W	1	W	43	Dolomite.
Torrance	--	--	--	1	10	11	Traprock.
Union	--	--	--	1	294	747	Do.
Valencia	5	W	W	3	2	4	Do.
Undistributed [1]	11	[r] 1,334	[r] 4,071	11	1,670	3,634	
Total [2]	43	[r][3] 2,913	[r][3] 5,337	46	2,768	5,499	

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Guadalupe (1971), Luna, McKinley, Mora (1971), Quay (1971), Rio Arriba, Sandoval (1971), Santa Fe, and Socorro (1972) Counties, and production for which no county breakdown is available.

[2] Data may not add to totals shown because of independent rounding.

[3] Excludes certain dimension stone.

Sand and Gravel.—Production of sand and gravel remained the most widespread mining activity in the State. The number of sand and gravel operations in 27 counties totaled 103, down from 129 in 1971. Shipments of sand and gravel decreased 14.3%, and value increased 6.2% (8.9 million tons valued at $8.0 million in 1971 to 7.6 million tons valued at $8.5 million in 1972). Government-and-contractor operations accounted for 2.0 million tons, 26% of the total State output, a significant increase when compared with 15% in 1971; commercial operations shipped the remainder.

Of 5.4 million tons of gravel, 1.7 million tons was used by commercial and government-and-contractor operations for road construction, and about 1.9 million tons for building construction. The remainder was used for fill and other purposes. Of 2.2 million tons of sand, a total of 1.5 million tons was used in building. The remaining 0.7 million tons was used for paving and fill.

Stone.—During 1972 there were 46 stone quarries in operation in the State or three more than in 1971. Stone shipments decreased 5.2% in tonnage and increased 2.8% in value.

Tables 14 and 15 give statistical details on stone activities in the State.

Other Nonmetals.—New Mexico also produced clays, lime, sulfur, and vermiculite. Clay was produced at several operations in Bernalillo County; lime was calcined by the Chino Division of Kennecott Copper Corp. at Hurley, Grant County, for use at the copper smelter; and sulfur was a byproduct of natural gas processing in Eddy, Lea, and Roosevelt Counties.

Table 15.—New Mexico: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension:				
Marble	--	--	W	1
Other stone	--	--	W	W
Sandstone	(1)	W	W	W
Crushed and broken:				
Limestone	2,254	4,448	[2] 1,388	[2] 3,000
Marble	--	--	W	1
Sandstone, quartz, and quartzite	W	W	110	165
Traprock	W	W	397	938
Other stone	585	757	864	W
Undistributed	[r] 73	[r] 132	10	1,395
Total [3]	[r] [4] 2,913	[r] [4] 5,337	2,768	5,499

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit; included with "Undistributed."

[2] Limestone used generally to include dolomite.

[3] Data may not add to totals shown because of independent rounding.

[4] Excludes certain dimension stone.

Table 16.—Principal producers

Commodity and company	Address	Type of activity	County
Carbon dioxide (natural):			
Schwartz Carbonic Co	Box 9737 El Paso, Tex. 79987	Well and extraction plant.	Harding.
S.E.C. Corp	do	do	Do.
Cement: Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Dry process, 2-rotary kiln plant.	Bernalillo.
Clays:			
El Paso Brick Co	Box 12336 El Paso, Tex. 79912	Open pit mine	Doña Ana.
Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Bernalillo.
Kinney Brick Co., Inc	Box 1804 Albuquerque, N. Mex. 87103	do	Do.
Coal:			
Kaiser Steel Corp	Box 58 Oakland, Calif. 90604	Underground mine, crushing plant, dense media-froth flotation cleaning plant.	Colfax.
The Pittsburg & Midway Coal Mining Co.	1600 Tenmain Center Kansas City, Mo. 64105	Strip mine, crushing plant, chemical and water treatment plant.	McKinley.
Utah International Inc	550 California St. San Francisco, Calif. 94104	Strip mine, crushing plant, dust suppression detergent treatment plant.	San Juan.
Copper:			
Earth Resources Co	Box 202 Cuba, N. Mex. 87013	Open pit, flotation mill	Sandoval.
Federal Resources Corp.[1]	1370 South 400 West Salt Lake City, Utah 84115	3 underground mines and mill.	Hidalgo.
Kennecott Copper Corp., Chino Mines Division.[1]	Hurley, N. Mex. 88043	Open pit mine, flotation mill, precipitation plant, smelter, and refinery.	Grant.
Phelps Dodge Corp., Tyrone Branch.[1]	Drawer B Tyrone, N. Mex. 88065	Open pit mine and mill	Do.
UV Industries[1]	136 East South Temple St. Salt Lake City, Utah 84111	Underground mine, open pit-underground mine, and flotation mill.	Do.
Fluorspar: Southwest Fluorspar Co.	Box 1158 Demming, N. Mex. 88001	Open pit mine	Do.
Gypsum: White Mesa Gypsum Co.	124 Jackson NE. Albuquerque, N. Mex. 87108	do	Sandoval.
Iron ore: Dotson Minerals Corp.	Box 115 Socorro, N. Mex. 87801	do	Socorro.
Ancho Rico Consolidated Mining Corp.	Ancho N. Mex. 88313	do	Lincoln.
Lime: Kennecott Copper Corp., Chino Mines Division	Hurley, N. Mex. 88043	Rotary-kiln plant	Grant.
Manganiferous ore: Luck Mining Co.	215 Market St. San Francisco, Calif. 94105	Open pit mine	Do.
Mica: Mineral Industries Commodities of America, Inc.	Box 2408 Santa Fe, N. Mex. 87501	do Dry grinding plant	Taos. Santa Fe.
Molybdenum:			
Kennecott Copper Corp., Chino Mines Division.	Hurley, N. Mex. 88043	*See* Copper	Grant.
Kerr-McGee Corp	Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Byproduct of uranium mining.	McKinley.
Molybdenum Corporation of America, Questa Division.	280 Park Ave. New York, N.Y. 10017	Open pit mine and flotation mill.	Taos.
Natural gas and petroleum:[2]			
Peat: Humus Organic Products.	506 Rosemont NE. Albuquerque, N. Mex. 87107	Humus bog	Sandoval.
Perlite:			
Grefco, Inc.. Dicalite Division.	333 North Michigan Ave. Chicago, Ill. 60601	Open pit mine; crushing, screening, and air-separation.	Taos.
Johns-Manville Perlite Corp.	2500 Miguelito Road Lompoc, Calif. 93436	do	Do.
Potash:			
AMAX Chemical Corp	Box 279 Carlsbad, N. Mex. 88220	Underground mine and refinery.	Eddy.
Duval Corp., Potash Division.	Box 511 Carlsbad, N. Mex. 88220	2 underground mines and refinery.	Do.
International Minerals & Chemical Corp.	Box 71 Carlsbad N. Mex. 88220	Underground mine	Do.

See footnotes at end of table.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Potash—Continued			
Kerr-McGee Chemical Corp.	Kerr-McGee Bldg. Oklahoma City, Okla. 73102	Underground mine	Lea.
National Potash Co	Box 731 Carlsbad, N. Mex. 88220	do do	Do.
Potash Co. of America, a division of Ideal Basic Industries, Inc.	Box 31 Carlsbad, N. Mex. 88220		Eddy.
Teledyne Potash Co	Box 101 Carlsbad, N. Mex. 88220	do	Do.
Pumice:			
General Pumice Corp	Box 449 Sante Fe, N. Mex. 87501	Open pit mine and crushing and screening plant.	Rio Arriba.
Morton Bros	Box 2000 Las Cruces, N. Mex. 88001	do	Doña Ana.
Twin Mountain Rock Co	Box 1009 Sheridan, Wyo. 82801	do	Union.
Salt:			
Morton Brothers	Rt. 1, Box 2000 Las Cruces, N. Mex. 88001	Open pit mine	Doña Ana.
Sand and gravel (commercial):			
Albuquerque Gravel Products Co.	Box 829 Albuquerque, N. Mex. 87103	Stationary plant	Bernalillo.
Burn Construction Co	P.O. Box 670 Las Cruces, N. Mex. 88001	Portable plants	Various.
Springer Corp	Box 572 Albuquerque, N. Mex. 87103	Pit and stationary crushing and screening plant.	Bernalillo.
Wylie Brothers Contracting Co.	Box 8526 Albuquerque, N. Mex. 87108	Portable plants	Do.
Silver:			
American Smelting and Refining Co.	120 Broadway New York, N.Y. 10005	*See* Zinc	Grant.
Stone:			
Ideal Cement Co., a division of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Quarry and plant	Bernalillo.
Jurgensen Construction Co	Box 25186 Albuquerque, N. Mex. 81712	Quarry	Santa Fe.
Uranium:			
The Anaconda Company, New Mexico Operations.	Box 638 Grants, N. Mex. 87020	Open pit mine and acid-leach process mill.	Valencia.
Kerr-McGee Corp	Box 218 Grants, N. Mex. 87020	6 underground mines and acid-leach process mill.	McKinley.
United Nuclear Corp	Box 199 Grants, N. Mex. 87020	4 underground mines Underground mine	Do. Valencia.
United Nuclear-Homestake Partners.	Box 98 Grants, N. Mex. 87020	6 underground mines and alkaline-leach process mill.	McKinley.
Zinc:			
American Smelting and Refining Co. [3]	120 Broadway New York, N.Y. 10005	Underground mine and mill.	Grant.

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[1] Also gold and silver.

[2] Most of the major oil and gas companies and many smaller companies operate in New Mexico and several commercial directories contain complete lists of them.

[3] Also lead.

The Mineral Industry of New York

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the New York State Museum and Science Service for collecting information on all minerals except fuels.

By E. Chin [1]

The total value of New York's mineral production was $320.5 million in 1972, compared with $299.3 million in the previous year. The State ranked first nationally in production of emery, garnet, talc, titanium, and wollastonite, and continued to be a major producer of zinc, cement, gypsum, salt, sand and gravel, and stone.

Legislation and Government Programs.—The New York State Board of Standards and Appeals adopted new or revised job safety standards for the mines, quarries, and sand, gravel, and crushed stone operations, contained in State Industrial Code Rules 17, 31, and 51. Amendments were adopted for Industrial Code 17, relating to sand, gravel, crushed stone and quarry operations, and for Rule 31, relating to underground mining operations. An entirely new Industrial Code Rule 51 that relates to open pit mining operations was promulgated by the board. Code Rule 51 contains all the provisions on open pit mining, which were previously contained in Code Rule 17, into one document comparable to the Federal safety standard for this specific industry. Enforcement of the new mining regulations will be carried out by the State Department of Labor. The revised standards, which cover both safety

Table 1.—Mineral production in New York [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays [2] ____ thousand short tons__	1,588	$1,742	1,601	$1,919
Emery ____ short tons__	1,585	W	2,883	W
Gem stones ____	NA	15	NA	16
Gypsum ____ thousand short tons__	415	2,376	486	3,079
Lead (recoverable content of ores, etc.)___short tons__	877	242	1,089	327
Natural gas ____ million cubic feet__	2,202	661	3,679	1,199
Peat ____ thousand short tons__	15	196	15	200
Petroleum (crude) ____ thousand 42-gallon barrels__	1,126	5,292	1,018	4,897
Salt ____ thousand short tons__	5,303	43,601	5,604	43,866
Sand and gravel ____ do____	23,221	28,328	26,722	36,952
Silver (recoverable content of ores, etc.) thousand troy ounces__	18	28	25	42
Stone ____ thousand short tons__	37,778	73,418	38,138	77,825
Zinc (recoverable content of ores, etc.)___short tons__	63,420	20,421	60,749	21,566
Value of items that cannot be disclosed:				
Abrasive garnet, cement, clay (ball), iron ore, lime, mercury, talc, titanium concentrate, wollastonite and values indicated by the symbol W_	XX	r 122,963	XX	128,565
Total ____	XX	r 299,283	XX	320,453
Total 1967 constant dollars ____	XX	254,480	XX	p 266,585

p Preliminary. r Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of |items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes ball clay; included with "Value of items that cannot be disclosed."

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[1] Physical scientist, Division of Nonferrous Metals—Mineral Supply.

and sanitation, are in accordance with the provisions of a State Plan Agreement with the U.S. Bureau of Mines.

As a result of the November 7, 1972, State election, the New York Legislature was authorized to borrow $1.15 billion for the Environmental Quality Bond Act. A special appropriation bill for this Act will be introduced in the 1973 State legislative session. The allocation of funds by the Environmental Quality Bond Act is as follows: $650 million to assist communities to build

Table 2.—Value of mineral production in New York, by county[1] [2]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Albany	$27,375	$31,068	Cement, stone, clays, sand and gravel.
Allegany	W	W	Petroleum, sand and gravel, natural gas.
Bronx	W	--	
Broome	W	W	Sand and gravel, clays, stone.
Cattaraugus	2,449	6,073	Sand and gravel, petroleum, peat, natural gas.
Cayuga	W	W	Stone, sand and gravel, natural gas.
Chautauqua	117	780	Petroleum, sand and gravel, natural gas.
Chemung	798	W	Sand and gravel.
Chenango	W	W	Do.
Clinton	W	W	Stone, sand and gravel.
Columbia	W	W	Cement, stone, sand and gravel, clays.
Cortland	W	W	Sand and gravel.
Delaware	1,402	1,533	Stone, sand and gravel.
Dutchess	13,761	W	Do.
Erie	12,911	12,294	Stone, lime, sand and gravel, gypsum, natural gas, clays.
Essex	[r] 13,267	7,781	Titanium concentrates, wollastonite, iron ore, sand and gravel, stone, garnet.
Franklin	W	175	Stone, sand and gravel.
Fulton	W	118	Sand and gravel.
Genesee	W	3,517	Gypsum, stone, sand and gravel, natural gas.
Greene	28,936	28,467	Cement, stone.
Herkimer	W	969	Stone, sand and gravel.
Jefferson	W	W	Do.
Lewis	58	44	Do.
Livingston	W	18,133	Salt, sand and gravel, stone, natural gas.
Madison	931	W	Stone, natural gas.
Monroe	W	4,608	Stone, sand and gravel, natural gas.
Montgomery	W	W	Stone, sand and gravel.
Nassau	W	W	Sand and gravel, clays.
Niagara	W	W	Stone, lime, sand and gravel.
Oneida	W	W	Stone, sand and gravel.
Onondaga	21,566	25,208	Lime, stone, cement, salt, sand and gravel, clays.
Ontario	W	2,044	Sand and gravel, stone, natural gas, peat.
Orange	W	W	Sand and gravel, stone, peat.
Orleans	W	812	Stone, sand and gravel.
Oswego	W	W	Sand and gravel, stone.
Otsego	W	W	Sand and gravel.
Putnam	--	W	Stone.
Rensselaer	W	W	Sand and gravel, stone.
Richmond	1	W	Sand and gravel.
St. Lawrence	35,564	38,210	Zinc, iron ore, talc, stone, sand and gravel, lead, silver, mercury.
Saratoga	W	W	Stone, sand and gravel.
Schenectady	W	W	Sand and gravel.
Schoharie	W	W	Cement, stone, clays, sand and gravel.
Schuyler	W	W	Salt, sand and gravel.
Seneca	W	W	Stone, natural gas, peat.
Steuben	W	W	Sand and gravel, stone, natural gas.
Suffolk	1,667	4,635	Sand and gravel.
Sullivan	W	W	Stone, sand and gravel.
Tioga	583	412	Sand and gravel.
Tompkins	W	5,656	Salt, stone, sand and gravel.
Ulster	W	W	Cement, stone, clays, sand and gravel.
Warren	W	W	Cement, garnet, stone.
Washington	W	W	Stone, sand and gravel.
Wayne	W	1,294	Do.
Westchester	W	1,109	Sand and gravel, stone, emery, peat.
Wyoming	W	W	Salt, natural gas.
Yates	W	W	Salt.
Undistributed[3]	130,291	125,560	
Total[4]	[r] 299,283	320,453	

[r] Revised. W Withheld to avoid disclosing individual company confidential data.

[1] Hamilton, Kings, New York, and Queens Counties are not listed because no production was reported.

[2] Natural gas and petroleum not listed by counties (1971), included with "Undistributed."

[3] Includes natural gas (1971), petroleum (1971), sand and gravel and gem stones that cannot be assigned to specific counties, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

new sewage treatment facilities; $175 million to assist communities to recover products and energy from solid waste and to develop environmentally sound land disposal where resource recovery is not feasible; $150 million to abate air pollution from State and municipal facilities; and $175 million to acquire forest preserve lands, wetlands, parklands, and other unique lands.

Table 3.—Indicators of New York business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force thousands	8,295.0	8,290.0	−0.1
Unemployment do	485.0	485.0	--
Employment:			
Manufacturing do	1,633.4	1,604.7	−1.8
Durable goods do	757.7	751.6	−.8
Nondurable goods do	875.8	853.1	−2.6
Mining do	7.4	7.1	−4.1
Contract construction do	272.1	269.1	−1.1
Earnings-average, weekly:			
Manufacturing	$145.84	$157.61	+8.1
Durable goods	$159.98	$173.87	+8.7
Nondurable goods	$134.17	$144.01	+7.3
Personal income:			
Total millions	91,742	97,694	+6.5
Per capita	$5,000	$5,319	+6.4
Construction activity: Portland cement shipments to and within New York thousand short tons	3,245	3,633	+12.0
Mineral production value millions	r $299.3	$320.5	+7.1

p Preliminary. r Revised.

Sources: Employment Review, New York State Department of Labor; Survey of Current Business; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

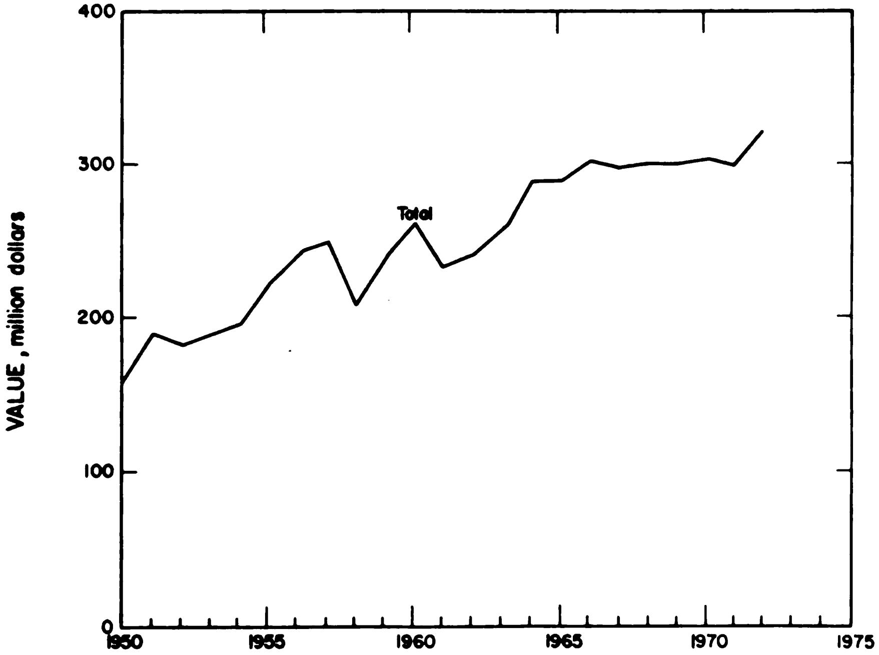

Figure 1.—Total value of mineral production in New York.

Employment and Injuries.—Total employment in New York State in 1972 was 7,805,000. Total unemployment in December 1972 was 485,000.

A comparison of total nonagricultural employment in the State, in thousands, by various sectors is as follows:

	1972	
	January	December
Manufacturing:		
Durable goods:		
Primary metal industries	65.1	69.2
Stone, clay, and glass products	40.4	42.6
All other durable goods	634.6	657.6
Nondurable goods:		
Chemical and allied products	79.6	79.0
Petroleum refining and related industries	10.1	9.3
All other nondurable	704.6	760.9
Mining	6.4	7.1
Other industries and services	5,315.8	5,487.3
Total employment	6,856.6	7,113.0

Source: New York State Department of Labor.

Environment.—The New York State Department of Environmental Conservation (EnCon) established in 1971 nine environmental conservation regions in the State to strengthen the department's services and law enforcement activities at the local level.

In 1972, 251 pollution abatement orders were issued to industry and municipalities throughout the State. To assure compliance with EnCon's clean-up schedule, the polluters pledged $1,470,500 in good faith bonds. This compares with a 1971 total of 127 abatement orders issued and $157,000 in compliance bonds pledged. Additionally, $70,700 was collected in penalty fines from the State's polluters in 1972, compared with $20,500 collected in 1971.

EnCon, under authority of section 17-0301 of the State Environmental Conservation Law, announced that public hearings will be held in mid-1973 to propose modification, alteration, amendment to, and/or repeal of present classifications and standards relating to the quality and purity now assigned to all State waters. The purpose of the hearings is to consider new and modified classifications and standards that will protect the public health and welfare, enhance and maintain the quality of waters, serve the purposes of the U.S. Public Law 92–500 and the Environmental Conservation Law of the State of New York, and that will protect the quality of waters for all uses including, but not limited to, recreational purposes, drinking water supplies, industrial water supplies, agricultural uses, navigation, and propagation of fish and wildlife.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	1,317	240	316	2,528	1	74	29.67	3,241
Nonmetal	1,369	259	355	2,858	--	79	27.64	1,064
Sand and gravel	1,887	199	375	3,224	--	58	17.99	466
Stone	3,001	274	822	6,679	--	106	15.87	544
Total	7,574	247	1,868	15,289	1	317	20.80	1,071
1972:[1]								
Metal	835	315	263	2,104	1	61	29.47	4,005
Nonmetal	1,305	270	353	2,820	--	89	31.56	1,009
Sand and gravel	1,085	203	221	1,843	2	30	17.36	6,890
Stone	2,540	270	686	5,629	1	124	22.21	1,657
Total	5,765	264	1,523	12,396	4	304	24.85	2,686

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasives, Manufactured.—The Carborundum Co., Electro Mineral Div., and General Abrasives Co., Div. of U.S. Industries, Inc., in Niagara County operated electric furnaces for producing fused aluminum oxide and silicon carbide. The finished products were used in abrasives and in refractories and other nonabrasives.

Metallic abrasives consisting of chilled iron shot and grit, annealed iron shot and grit, and cut wire shot, were produced by Cleveland Metal Abrasive Co., Div. of Fanner Mfg. Co., and Pellets, Inc., in Erie County.

Calcium-Magnesium Chloride.—Allied Chemical Corp. produced calcium-magnesium chloride at Onondaga as a byproduct of the manufacture of soda ash. Production in 1972 decreased 7% from that of the previous year.

Cement.—Cement ranked first in value among the State's mineral industries. Eleven plants were in operation, of which nine were in eastern and two in western New York. Four plants produced portland cement exclusively; six produced portland and masonry cements; and one produced masonry cement only. Cement production was from seven counties; in quantity, Albany County ranked first, followed by Greene, Ulster, Columbia, Warren, Schoharie, and Onondaga Counties.

Clays.—Total production of common and shale clay in 1972 was 1.6 million short tons valued at $1,919,000. Common and shale clay was mined in Albany, Broome, Columbia, Erie, Nassau, Onondaga, Schoharie, and Ulster Counties. Ball clay was mined in Albany County. Clay was used in lightweight aggregate and portland cement, and for pottery and abrasive bonding.

Emery.—Virtually all of the United States emery production was from one open pit mine, DeLuca Emery Mine, Inc., in Westchester County. Output of emery increased in quantity and value above that in the previous year. Uses for emery were mainly as aggregate for heavy-duty nonslip floors and pavements, and for general abrasive purposes.

Garnet.—Abrasive garnet production in 1972 decreased 1% in quantity but increased 3% in value from that of 1971. Garnet from an open pit mine in Warren County operated by Barton Mines Corp. was sold for precision uses in coated abrasives, glass grinding and polishing, and metal lapping. Garnet recovered as a byproduct of wollastonite mining by Interpace Corp. in Essex County was sold for use in sandblasting and for general abrasive purposes. New York State ranked first in the Nation in the production of garnet in 1972.

Gem Stones.—The collection of gem stones and mineral specimens was principally by amateurs. The value of gem stone production was estimated to be $16,000.

Graphite, Manufactured.—Graphite Manufactured from petroleum coke and other materials was produced by four firms at plants in Niagara County. The producing companies were Airco, Inc., Airco Speer Electrodes Division, The Carborundum Co., Great Lakes Carbon Corp., and Union Carbide Corp. The principal uses were for anodes, electrodes, electric motor brushes, fibers, and crucibles and other refractories. Synthetic graphite powder was used as a carbon riser in steelmaking, an additive in nonferrous metallurgy, foundry facings, and in lubricants.

Gypsum.—United States Gypsum Co., National Gypsum Co., and Georgia-Pacific Corp. mined crude gypsum in Erie and Genesee Counties. Output increased 17% to a a record 485,900 tons. United States Gypsum, National Gypsum, and Georgia-Pacific calcined gypsum in Bronx, Erie, Genesee, Richmond, Rockland, and Westchester Counties. Output expanded 23% to a record 1,138,000 tons.

Table 5.—New York: Crude gypsum production

(Thousand short tons and thousand dollars)

Year	Active mines	Quantity	Value
1968	5	570	2,925
1969	4	492	2,945
1970	3	425	2,737
1971	3	415	2,376
1972	3	486	3,079

Ilmenite.—Ilmenite concentrate was produced from the MacIntyre Development of N L Industries, Inc., the largest ilmenite mine in the United States. The open pit titaniferous-magnetite deposit is located near Tahawus, Essex County. Shipments and value in 1972 were, respectively, 10% and 17% below the 1971 levels. The output was used principally in the manufacture of titanium dioxide pigment.

Lime.—Allied Chemical Corp., Bethlehem Steel Corp., and Union Carbide Corp. produced lime in Erie, Niagara, and Onondaga Counties for alkalies, steel furnaces, and calcium carbide. The lime was consumed mainly in New York. Total lime consumption in New York was 998,500 tons.

Mullite, Synthetic.—The Carborundum Co. produced fused, synthetic mullite at its plant in Niagara County. Output was 2,770 short tons valued at $497,000.

Perlite.—Crude perlite mined in Western States was expanded at plants of four companies. National Gypsum Co. operated plants in Bronx and Erie Counties, Georgia-Pacific Corp. in Erie County, United States Gypsum Co. in Genesee, Richmond, and Rockland Counties, and Buffalo Perlite Corp. in Erie County. The most important use was in accoustical building plaster. Other uses included loose fill insulation, soil conditioning, lightweight concrete aggregate, and filtering.

Salt.—The State output of salt in 1972 was 5,604,451 short tons valued at $43,866,000. More than 0.5 million tons of salt were reported each from Livingston, Onondaga, and Tompkins Counties.

Table 6.—New York: Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value
1968	5,218	42,488
1969	5,582	45,561
1970	5,990	47,254
1971	5,303	43,601
1972	5,604	43,866

Most of the evaporated salt produced was used for food processing and seasoning. Another large use for evaporated salt was for manufacturing chlorine and other chemicals. The principal use for rock salt was for ice control on highways in the Northeastern States. Other important uses

Table 7.—New York: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	7,829	10,841	8,795	13,573
Fill	1,383	496	1,396	549
Paving	2,731	3,496	2,997	4,181
Other uses [1]	560	1,341	719	1,654
Total [2]	12,503	16,174	13,907	19,958
Gravel:				
Building	4,089	6,450	5,594	9,684
Fill	912	771	1,135	905
Paving	3,156	3,603	3,265	4,953
Miscellaneous	440	413	573	663
Other uses	183	266	119	158
Total [2]	8,781	11,504	10,687	16,363
Government-and-contractor operations:				
Sand:				
Fill	144	17	36	12
Paving	19	10	30	8
Other uses	365	219	427	152
Total [2]	528	246	492	172
Gravel:				
Building	45	51	--	--
Fill	386	76	462	72
Paving	801	255	1,120	365
Other uses	177	22	54	21
Total [2]	1,408	404	1,636	459
Total sand and gravel [2]	23,221	28,328	26,722	36,952

[1] Includes engine, filtration, foundry, molding, railroad ballast, and other sands.

[2] Data may not add to totals shown because of independent rounding.

for rock salt were in the chemical and food industries. Salt in brine was used mainly for the manufacture of soda ash; some salt in brine was used for the manufacture of chlorine and other chemicals. Salt for chemical manufacture was consumed mainly within the State.

Rock salt was produced from one mine each in Livingston, Thompkins, and Yates Counties. Brine salt produced from two operations in Schulyer County, and one operation each in Onondaga and Wyoming Counties.

The Hewitt-Robins Div. (Hewitt-Robins) of Litton Industries, Inc., will build a comprehensive conveyorized, bulk materials handling system for the Retsof mine of the International Salt Co. The Retsof mine, located in Livingston County, is the world's largest underground salt mine.

According to Hewitt-Robins, the underground conveyor system will have one of the highest capacities of any underground bulk salt handling system in the world. The system, which will replace an electric locomotive-mine car complex, will comprise more than 5-miles of underground main line conveyors and underground storage and reclaim facilities. When installation is completed, the mined salt will move to underground surge bins at a maximum rate of 1,200 short tons per hour, with a maximum rate of reclaim from storage to an existing skip hoist at 1,000 tons per hour.

Sand and Gravel.—Production of sand and gravel in the State in 1972 was 26.7

Table 8.—New York: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Broome	3	556	1,088	5	470	907
Cattaraugus	10	1,743	2,407	12	1,907	3,186
Chautauqua	3	233	117	8	700	162
Chemung	4	698	798	3	W	W
Chenango	6	233	W	3	213	W
Delaware	3	12	10	1	22	10
Dutchess	10	1,180	1,444	17	1,890	3,162
Erie	7	1,019	2,255	7	961	2,099
Franklin	4	216	W	2	81	48
Fulton	4	140	W	6	180	118
Genesee	3	109	216	6	324	W
Herkimer	4	114	94	3	67	W
Jefferson	2	267	W	4	W	187
Lewis	1	106	24	2	44	8
Livingston	2	W	W	12	1,084	W
Monroe	4	568	878	7	477	W
Montgomery	4	W	W	1	W	58
Niagara	--	--	--	1	(1)	1
Oneida	9	926	1,214	11	1,208	2,041
Onondaga	6	420	457	6	692	631
Ontario	10	846	1,001	19	960	1,068
Orange	10	702	1,015	10	835	1,382
Oswego	3	W	W	4	333	W
Rensselaer	12	882	1,044	15	882	1,252
Richmond	1	68	1	2	W	W
Rockland	3	250	658	3	364	600
St. Lawrence	8	430	424	7	393	381
Saratoga	9	254	465	6	258	559
Schenectady	2	W	W	4	535	W
Schoharie	1	W	W	1	5	W
Schuyler	1	12	W	1	57	6
Steuben	8	794	1,328	5	779	1,149
Suffolk	8	1,777	1,667	13	4,509	4,635
Sullivan	3	161	279	5	224	W
Tioga	5	399	583	4	240	412
Wayne	6	146	64	6	203	W
Westchester	--	--	--	1	164	W
Undistributed[2]	[r] 51	7,958	8,801	32	5,662	12,890
Total[3]	230	28,221	28,328	255	26,722	36,952

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Albany, Allegany, Bronx (1971), Cayuga, Clinton, Columbia, Cortland, Essex, Nassau, Orleans, Otsego, Tompkins, Ulster, and Washington (1972) Counties, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

million short tons valued at $36,952,000. There were 255 sand and gravel mining operations within the State. These mines were operated by construction companies and government operators working on various Federal, State, county, and local government contracts.

Stone.—Stone was the second most valuable mineral commodity produced in the State. Crushed limestone and dolomite, considered together as carbonate rock, were predominant in the State, accounting for most of the tonnage and value of all stone produced.

The chief uses for crushed dolomite and limestone were as an aggregate material in various construction applications and for the manufacture of cement and lime. Other uses were agricultural stone, railroad ballast, riprap, asphalt filler, and fluxing stone.

Basalt (traprock) ranked second in quantity of stone production within the State. The chief uses were for concrete aggregate and road metal.

Sandstone, which included quartzite, was quarried as dimension stone and as crushed stone. The chief uses of dimension sandstone were for curbing and flagging, and for architectural applications. Crushed sandstone was used for concrete aggregate and road metal.

Slate was quarried and prepared for uses as flagstone, roofing, structural, and sanitation stone. Granite was quarried and dressed mostly for building stone, while crushed granite was used for concrete aggregate, road metal, and railroad ballast.

Table 9.—New York: **Crushed and broken limestone and dolomite sold or used by producers, by use**

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Bituminous aggregate	4,301	9,596	4,976	11,802
Concrete aggregate	7,461	13,745	5,805	11,752
Dense graded road base stone	2,868	5,561	5,512	11,571
Macadam aggregate	564	902	412	1,036
Surface treatment aggregate	881	2,047	1,540	3,524
Unspecified construction aggregate and roadstone	6,900	11,656	3,102	6,570
Agricultural limestone	451	1,669	318	1,456
Cement	7,534	6,902	7,826	7,114
Railroad ballast	228	432	189	372
Riprap and jetty stone	511	1,035	598	1,361
Other uses [1]	2,011	4,562	4,073	9,031
Total [2]	33,710	58,108	34,350	65,589

[1] Data include fluxing stone, stone sand, chemical stone, drain fields, fill, stucco (1971), building products, and uses not specified.

[2] Data may not add to totals shown because of independent rounding.

Sulfur.—Ashland Oil, Inc., recovered 3,675 long tons of sulfur at its Buffalo refinery in Erie County.

Talc.—The 1972 output of talc increased 16% in quantity and 5% in value above the 1971 level. New York continued to be the leading-talc-producing State. Gouverneur Talc Co., Inc. and International Talc Co., Inc. mined talc from two underground mines in St. Lawrence County. International Talc Co. also mined talc from an open pit operation in St. Lawrence County. Crude talc was ground in company-owned mills and used mainly in ceramics and as a mineral filler in paints. Smaller quantities were exported and used as a mineral filler in floor tile, rubber, paper, and miscellaneous products.

Vermiculite.—Crude vermiculite mined in other States was exfoliated at the Zonolite Div. plant of W. R. Grace & Co., Weedsport, Cayuga County. The expanded vermiculite was used for loose fill insulation, soil conditioning, ultralightweight concrete aggregate, and building plaster aggregate.

Wollastonite.—The entire U.S. production of crude wollastonite was mined and beneficiated at the Willsboro mine in Essex County, operated by Interpace Corp. Production in 1972 of refined wollastonite increased 35% and value of shipments increased 57% above the 1971 level. The refined wollastonite was used as an ingredient in ceramic products and as a filler in paints and plastics.

METALS

Aluminum.—Production of primary aluminum for the Massena plants in St. Lawrence County of Aluminum Co. of America (Alcoa) and Reynolds Metals Co. decreased in both tonnage and value from that of 1971. Alcoa planned to expand and modernize its facility, to be completed in mid-1976 at a cost of approximately $60 million. The modernization program includes the installation of the patented Alcoa 398 emission control process developed for capturing the recycling fluoride emissions generated during smelting. Upon completion of the modernization program, Alcoa's capacity at its Massena facility will be increased from 130,000 short tons of primary aluminum metal per year to 190,000 short tons per year. Additionally, the electrical power consumption per pound of metal produced will be reportedly 10% less than the present consumption rate.

Iron Ore.—Mine production of magnetite in the State decreased in 1972 from the previous year's output. Republic Steel Corp. closed its underground mining operation at Port Henry in Essex County, reportedly due to the high costs of production. The entire mine production in 1972 was from two open pit operations, one by N L Industries, Inc., in Essex County as a byproduct of ilmenite production, and the other by the Jones & Laughlin Steel Corp. in St. Lawrence County.

All of the ore was beneficiated and most of the concentrates were agglomerated before shipment. Principal uses for shipments were in the manufacture of pig iron and steel, and some in the manufacture of cement, for heavy media separation, and for ballast.

Lead.—Lead was recovered as a byproduct of zinc mining at the Balmat and Edwards mines of the St. Joe Minerals Corp. in St. Lawrence County. Lead recovery varies from year to year depending on the proportion of ore coming from that section of the mining operation where the vein has a higher lead content. The lead concentrate was shipped to the company lead smelter at Herculaneum, Mo.

Table 10.—New York: Mine production (recoverable) of silver, lead, and zinc

	1970	1971	1972
Mines producing: Lode	2	2	2
Material sold or treated: Zinc ore ... thousand short tons	[1] 742	[1] 779	852
Production (recoverable):			
Quantity:			
Silver ... troy ounces	23,830	17,928	25,070
Lead ... short tons	1,280	877	1,089
Zinc ... do	58,577	63,420	60,749
Value:			
Silver ... thousands	$42	$28	$42
Lead ... do	400	242	327
Zinc ... do	17,947	20,421	21,566
Total ... do	18,389	20,691	21,935

[1] Reclassified as zinc ore.

Mercury.—Mercury, recovered as a byproduct at the Balmat and Edwards zinc mines of St. Joe Minerals Corp., was shipped to and recovered at the company smelter in Monaca, Pa.

Silver.—Silver was recovered from lead concentrates shipped from the Balmat and Edwards mines of St. Joe Minerals Corp. in St. Lawrence County. Silver recovery reflects the demands for silver-free lead.

Zinc.—New York ranked fourth to Tennessee in the U.S. zinc production in both quantity and value. The entire production in the State was from the Balmat and Edwards mines of the St. Joe Minerals Corp. in St. Lawrence County. In the fall of 1971, St. Joe opened its new mine and concentrator, Balmat No. 4, which made the Balmat and Edwards mine complex the largest single zinc mining operation in the United States.

MINERAL FUELS

Natural Gas.—The production of natural gas in New York in 1972 increased 67% over production in the previous year. The quantity and value of natural gas production in the State for 1968–1972 were as follows:

Year	Quantity[1] (million cubic feet)	Value (thousand dollars)
1968	4,632	1,390
1969	4,861	1,458
1970	3,358	1,017
1971	2,202	661
1972	3,679	1,199

[1] Marketed production of natural gas represents gross withdrawals less gas used for repressuring and quantities vented and flared.

Iroquois Gas Corporation (Iroquois) completed the installation of its eleventh major underground storage natural gas field, bringing storage capacity for Iroquois to over 37 billion cubic feet of gas. During 1973, Iroquois will continue its participation in deep well drilling in the Appalachian Basin south of Buffalo and in northern Pennsylvania. Drilling efforts in 1972 reportedly identified many promising areas for natural gas exploration.

Peat.—Production and shipments of peat in 1972 were, respectively, 14,984 and 14,507 short tons. Shipments of peat by five producers were valued at $200,365 in 1972. Orange County was the leading producing area; output was also reported from Cattaraugus, Ontario, Seneca, and Westchester Counties. The use for peat was mainly in general soil improvement, although some peat was used for potting.

Petroleum.—Crude oil production in the State was 1,018 million barrels in 1972, a decrease of 108,000 barrels from 1971 production. The 1972 value of crude oil produced was $4,897,000 compared with $5,292,000 in the previous year. At yearend 1972, there were 5,427 producing wells compared with 5,860 wells at the end of 1971.

The New England Petroleum Corp. announced plans to build a $70 million fuel oil and synthetic gas complex at Oswego. The proposed plant will process 100,000 barrels per stream day of crude oil to produce 50,000 barrels per stream day of heavy industrial fuel oil, and 100 million cubic feet of synthetic natural gas from naphtha. Both products will be for sale solely to the Niagara Mohawk Power Corp.

Table 11.—New York: Oil and gas well drilling in 1972, by county

County	Proved field wells[1]			Exploratory			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Allegany	18	1	--	--	--	3	22	33,478
Cattaraugus	34	--	2	1	1	2	40	70,440
Chautauqua	38	3	--	--	1	1	43	44,205
Erie	--	7	--	--	1	--	8	11,608
Genesee	--	5	--	--	--	2	7	12,781
Ontario	--	1	--	--	--	--	1	2,506
Orleans	--	--	--	--	--	1	1	2,873
Steuben	5	2	--	--	--	1	8	19,044
Total	95	19	2	1	3	10	130	196,935

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 12.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasives:			
Artificial:			
The Carborundum Co. Electro Mineral Div.	P.O. Box 423 Niagara Falls, N.Y. 14302	Plant	Niagara.
General Abrasives Co., Div. of U.S. Industries, Inc.	Niagara Falls, N.Y. 14302	do	Do.
Metallic:			
Cleveland Metal Abrasive Co. Div. of Fanner Mfg. Co.	Brookside Park Cleveland, Ohio 44109	do	Erie.
Pellets, Inc	533 S. Niagara St. Tonawanda, N.Y. 14150	do	Do.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Cement:			
Alpha Portland Cement Co.[1]	15 South Third St. Easton, Pa. 18043	Plant	Greene.
Alpha Portland Cement Co	do	do	Onondaga.
Atlantic Cement Co., Inc.[1]	P.O. Box 3 Ravena, N.Y. 12143	do	Albany.
Century Cement Mfg. Co., Inc	Rosendale, N.Y. 12472	do	Ulster.
Glens Falls Portland Cement Co.[2] Div. of Flintkote Co.	313 Warren St. Glen Falls, N.Y. 12801	do	Warren.
Hudson Cement Division,[2] Colonial Sand & Stone Co., Inc.	1740 Broadway New York, N.Y. 10019	do	Ulster.
Lehigh Portland Cement Co.[2]	718 Hamilton St. Allentown, Pa. 18105	do	Greene.
Marquette Cement Mfg. Co.[2]	20 N. Wacker Dr. Chicago, Ill. 60606	do	Do.
Penn Dixie Cement Corp.[1]	P.O. Box 152 Nazareth, Pa. 18064	do	Schoharie.
Universal Atlas Cement Div.,[1] U.S. Steel Corp.	Chatham Center Pittsburgh, Pa. 15230	do	Columbia.
Clays (miscellaneous):			
Atlantic Cement Co., Inc	Box 30, Ravena, N.Y. 12143	Pit	Albany.
Hudson Lightweight Stone Div., Colonial Sand & Stone Co., Inc.	1740 Broadway New York, N.Y. 10019	Pit	Ulster.
Hudson Valley Lightweight Aggregate Corp.	P.O. Box 9138 Richmond, Va. 23227	Pit	Do.
New York Trap Rock Corp	162 Old Mill Rd. W. Nyack, N.Y. 10994	Pit	Do.
Universal Atlas Cement Div., U.S. Steel Corp.	Chatham Center Pittsburgh, Pa. 15230	Pit	Albany and Columbia.
Emery:			
DeLuca Emery Mine, Inc	926 Constant Ave. Peekskill, N.Y. 10566	Pit	Westchester.
Garnet:			
Barton Mines Corp	North Creek, N.Y. 12853	Pit	Warren.
Gypsum:			
Georgia-Pacific Corp. Gypsum Div.[4]	P.O. Box 311 Portland, Ore. 97207	Underground mine and calcining plant.	Erie.
		Calcining plant	Westchester.
National Gypsum Co.[4]	325 Delaware Ave. Buffalo, N.Y. 14202	Underground mine and calcining plant.	Erie.
		Calcining plant	Bronx.
United States Gypsum Co.[4]	101 S. Wacker Dr. Chicago, Ill. 60606	Underground mine and calcining plant.	Genesee.
		Calcining plants	Richmond and Rockland.
Iron ore:			
Jones & Laughlin Steel Corp	Star Lake N.Y. 13690	Pit	St. Lawrence.
NL Industries, Inc. McIntyre Division	Tahawus, N.Y. 12879	Pit	Essex.
Lead: *See* Zinc.			
Lime:			
Bethlehem Steel Corp	701 E. Third St. Bethlehem, Pa. 18016	Plant	Erie.
Industrial Chemicals Div., Allied Chemical Corp.	P.O. Box 70 Morristown, N.J. 07960	do	Onondaga.
Union Carbide Corp	Box 66 Niagara Falls, N.Y. 14302	do	Erie.
Mercury: *See* Zinc.			
Peat:			
Sterling Forest Peat Co., Inc	P.O. Box 608 Tuxedo, N.Y. 10987	Bog	Orange.
Petroleum:			
Mobil Oil Corp	Buffalo, N.Y. 14221	Refineries	Do.
Frontier Oil & Refining Co. Div. of Ashland Oil & Refining Co.	Tonawanda, N.Y. 14150	do	Do.
Salt:			
Evaporated:			
Morton Salt Co	110 N. Wacker Dr. Chicago, Ill. 60606	Well	Wyoming.
The Watkins Salt Co., Inc.[5]	Box 150 Watkins Glen, N.Y. 14891	do	Schuyler.
Rock:			
Cayuga Rock Salt Co., Inc	191 Portland Pt. Rd. Myers, N.Y. 14866	Underground	Tompkins.
International Salt Co	Clarks Summit, Pa. 18411	do	Livingston.
Brine:			
Industrial Chemicals Div.,[6] Allied Chemical Corp.	P.O. Box 70 Morristown, N.J. 07960	Well	Onondaga.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel:			
Broad Hollow Estates	Box 722, Rte. 110 Melville, N.Y. 11746	Pit	Suffolk.
Colonial Sand & Stone Co., Inc.	1740 Broadway New York, N.Y. 10019	do	Nassau and Dutchess.
General Crushed Stone Co	712 Drake Bldg. Easton, Pa. 18042	do	Cattaraugus and Chemung
Roanoke Marbro Sand & Gravel Corp.	P.O. Box 172 Riverhead, L.I., N.Y. 11901	do	Suffolk.
West Hill Silica Sand Mining	P.O. Box 722 Melville, N.Y. 11746	do	Do.
Silver: *See* Zinc.			
Smelters (aluminum):			
Aluminum Co. of America	1501 Alcoa Bldg. Pittsburgh, Pa. 15222	Plant	St. Lawrence.
Reynolds Metals Co	6601 Broad Street Rd. Richmond, Va. 23215	do	Do.
Stone:			
Basalt (crushed):			
Rockland Materials Corp	P.O. Box 57, Suffern, N.Y. 10901	Quarry	Rockland.
Granite (dimension):			
Di Rienzo Brothers	107 Main St. Tuckahoe, N.Y. 10707	do	Westchester.
Frank Baratta, P. D'Amato & Angelo Cucchiella, T/A Dunwoodie Stone Quarry Inc.	941 Midland Ave. Yonkers, N.Y. 10707	do	Do.
Granite (crushed):			
Northern Materials, Inc	Route 9 Chestertown, N.Y. 12817	do	Warren.
Limestone and dolomite (crushed and broken):			
Appalachian Stone Division Martin Marietta Corp.	Box 120 Mercersburg, Pa. 17236	do	Rockland.
Buffalo Crushed Stone Co	10 Park Place Morristown, N.J. 07960	do	Erie.
The Buffalo Slag Co., Inc. Federal Crushed Stone Div.	111 Great Arrow Ave. Buffalo, N.Y. 14216	do	Do.
The Callanan Road Improvement Co.	So. Bethlehem, N.Y. 12161	do	Albany and Ulster.
Dolomite Products Co.[7]	1150 Penfield Rd. Rochester, N.Y. 14625	do	Monroe.
The General Crushed Stone Co.	712 Drake Bldg. Easton, Pa. 18042	do	Cayuga, Genesee, Herkimer, Jefferson, Livingston, Onondaga, Ontario, Wayne.
Industrial Chemicals Div., Allied Chemical Corp.	P.O. Box 70 Morristown, N.J. 07960	do	Onondaga.
Niagara Stone Div. of Great Lakes Color Printing Corp.	Quarry Road Niagara Falls, N.Y. 14304	do	Niagara.
Marble (crushed):			
Balducci Crushed Stone Co	Box 158 Gouverneur, N.Y. 13642	do	St. Lawrence.
Miscellaneous (crushed):			
Fitzgerald Bros. Construction Co., Inc.	504 Broadway Troy, N.Y. 12180	do	Rensselaer.
Sandstone (dimension):			
Adirondak Stone Quarries, Inc.	P.O. Box 184 Malone, N.Y. 12953	do	Franklin.
Finger Lakes Stone Co., Inc.	Box 401 Ithaca, N.Y. 14850	do	Tompkins.
Willis Hankins	Hancock, N.Y. 13783	do	Delaware.
Heldeberg Bluestone & Marble Inc.	East Berne, N.Y. 12059	do	Albany and Delaware.
Johnston & Rhodes Bluestone Co.	East Branch, N.Y. 13756	do	Delaware.
Manufacturing Concrete Prod.	359 Elm Street Rd. Malone, N.Y. 12953	Processor	Franklin.
Northern Aggre. Inc	1306 Silk Rd. Fulton, N.Y. 13069	do	Oswego.
W. R. Strong & Son	43 Wheeler St. Deposit, N.Y. 13754	do	Broome and Delaware.
Paul Tompkins Estate	Hancock, N.Y. 13783	do	Do.
Sandstone (crushed and broken):			
Steuben Crushed Div., A. L. Blades & Sons, Inc.	County Route #10 Bath, N.Y. 14810	Quarry	Steuben.
Sullivan Highway Products Corp.	P.O. Box 392 Monticello, N.Y., 12701	do	Sullivan.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone— Continued			
Slate (dimension):			
Darius Slate Products	Middle Granville, N.Y. 12849	Quarry	Washington.
A. A. Hadeka Quarry	49 South St. Poultney, Vt. 05764	do	Do.
McCullen Slate Co	R.D. 1, Granville, N.Y. 12832	do	Do.
The A. B. Potter Slate Co. Inc.	Poultney, Vt. 05764	do	Do.
Ritchie Brothers Slate Co	Middle Granville, N.Y. 12849	do	Do.
Sheldon Slate Products Co		do	Do.
Western Slate Co	Box 104, Granville, N.Y. 12832	do	Do.
Williams Bros. Slate Co	Middle Granville, N.Y. 12849	do	Do.
Talc:			
Gouverneur Talc Co., Inc	Gouverneur, N.Y. 13642	Underground	St. Lawrence.
International Talc Co., Inc	420 Lexington Ave. New York, N.Y. 10006	do	Do.
Titanium concentrate: Ilmenite:			
NL Industries, Inc.[8]	100 Chevalier Ave. So. Amboy, N.J. 08879	Pit	Essex.
Wollastonite:			
Interpace Corp.[9]	Willsboro, N.Y. 12996	Underground	Do.
Zinc:			
St. Joe Minerals Corp.[10]	250 Park Ave. N.Y., N.Y. 10017	Mine	St. Lawrence.

[1] Also crushed limestone and shale.
[2] Also crushed limestone.
[3] Also crushed limestone and clay.
[4] Also expanded perlite.
[5] Also brine.
[6] Also evaporated salt and crushed limestone.
[7] Also sand and gravel.
[8] Also iron ore.
[9] Also garnet.
[10] Also silver and lead and mercury.

The Mineral Industry of North Carolina

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Office of Earth Resources, North Carolina Department of Natural and Economic Resources, for collecting information on all minerals except fuels.

By Roland W. Merwin [1] and Stephen G. Conrad [2]

In 1972 North Carolina's total mineral production was valued at $116.3 million, an increase of approximately $6.8 million, or 6% above that of the previous year.

Stone was the leading mineral commodity produced, contributing 54% of the total mineral production value, followed by sand and gravel, which accounted for 13%. Cement, clays, feldspar, lithium minerals, mica, and phosphate rock were also important contributors together providing 32% of the State's 1972 mineral production. The remaining 1% was derived from the production of asbestos, gem stones, iron ore, kaolin, olivine, and talc and pyrophyllite.

The leading mineral producers were Ideal Cement Co., Martin Marietta Aggregates (formerly Superior Stone Co.), Nello L. Teer Co., Texas Gulf, Inc., and Vulcan Materials Co. Together, they accounted for 61% of the State's mineral production.

North Carolina ranked first among the States in the production of feldspar, lithium minerals, and mica; second in the production of olivine; and fourth in the production of asbestos, clays, and phosphate rock.

Legislation and Government Programs.—The Office of Earth Resources, State Department of Natural and Economic Resources, was actively engaged in geologic and other

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[1] Mining engineer, Division of Nonmetallic Minerals—Mineral Supply.

[2] Director, Office of Earth Resources, North Carolina Department of Natural and Economic Resources.

Table 1.—Mineral production in North Carolina [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays [2] .... thousand short tons..	3,503	$3,802	3,862	$4,478
Feldspar .... short tons..	393,811	4,681	439,838	6,030
Gem stones	NA	30	NA	32
Mica:				
Scrap .... thousand short tons..	67	1,770	91	2,942
Sheet .... pounds..	8,705	3	--	--
Sand and gravel .... thousand short tons..	14,240	14,690	13,485	14,615
Stone .... do..	30,917	58,026	32,297	62,741
Talc and pyrophyllite .... short tons..	85,289	522	89,334	594
Value of items that cannot be disclosed:				
Asbestos, cement, clay (kaolin), copper (1971), gold (1971), iron ore, lead (1971), lithium minerals, olivine, phosphate rock, silver (1971), tungsten (1971), and zinc (1971)	XX	r 25,996	XX	24,896
Total	XX	r 109,520	XX	116,323
Total 1967 constant dollars	XX	93,125	XX	p 96,769

p Preliminary. r Revised. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin, included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in North Carolina, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Alamance	W	W	Stone, clays, sand and gravel, talc.
Alexander	$11	$8	Sand and gravel.
Alleghany	W	W	Stone.
Anson	W	W	Sand and gravel.
Ashe	W	90	Do.
Avery	958	996	Mica, clays, sand and gravel, stone, iron ore.
Beaufort	W	W	Phosphate rock, sand and gravel.
Bertie	W	W	Sand and gravel.
Bladen	W	W	Do.
Brunswick	10	11	Do.
Buncombe	W	W	Stone, sand and gravel.
Burke	W	W	Do.
Cabarrus	W	W	Stone, clays, sand and gravel.
Caldwell	449	6	Sand and gravel.
Camden	2	2	Do.
Carteret	3	8	Do.
Caswell	W	W	Stone.
Catawba	W	W	Stone, sand and gravel, clays.
Chatham	W	W	Clays, stone.
Cherokee	W	W	Stone, talc.
Chowan	5	5	Sand and gravel.
Clay	--	33	Stone.
Cleveland	W	6,898	Stone, mica, lithium minerals, feldspar, clays, sand and gravel.
Columbus	36	2	Sand and gravel.
Craven	W	W	Stone, sand and gravel.
Cumberland	W	W	Sand and gravel, clays.
Currituck	9	10	Sand and gravel.
Davidson	874	W	Stone, sand and gravel, clays.
Davie	W	38	Sand and gravel.
Duplin	W	W	Do.
Durham	W	W	Stone, clays.
Edgecombe	273	285	Sand and gravel.
Forsyth	W	W	Stone, sand and gravel.
Franklin	W	W	Sand and gravel.
Gaston	W	W	Lithium minerals, stone, sand and gravel.
Gates	6	6	Sand and gravel.
Graham	W	W	Stone.
Granville	W	W	Stone, talc.
Greene	55	W	Sand and gravel.
Guilford	W	6,594	Stone, clays, sand and gravel.
Halifax	W	W	Clays, sand and gravel.
Harnett	3,246	4,049	Sand and gravel, clays.
Haywood	W	W	Stone, sand and gravel.
Henderson	1,124	W	Stone, clays.
Hertford	116	185	Sand and gravel.
Hoke	6	6	Do.
Hyde	5	5	Do.
Iredell	W	1,266	Stone, sand and gravel, clays.
Jackson	1,705	W	Stone, sand and gravel, asbestos.
Johnston	W	W	Stone, sand and gravel.
Jones	W	W	Do.
Lee	W	1,517	Stone, clays, sand and gravel.
Lenoir	W	W	Sand and gravel.
Lincoln	22	24	Do.
McDowell	489	W	Do.
Macon	W	W	Stone, sand and gravel.
Madison	W	240	Stone.
Martin	1	1	Sand and gravel.
Mecklenburg	W	W	Stone.
Mitchell	4,374	5,860	Feldspar, mica, stone.
Montgomery	W	W	Stone, clays, sand and gravel.
Moore	888	566	Talc, sand and gravel, stone, clays.
Nash	W	W	Stone, sand and gravel.
New Hanover	W	W	Cement, stone, clays, sand and gravel.
Northampton	W	W	Sand and gravel.
Onslow	W	W	Stone, sand and gravel.
Orange	W	W	Stone, talc.
Pamlico	110	4	Sand and gravel.
Pasquotank	11	12	Do.
Pender	8	9	Do.
Perquimans	5	5	Do.
Person	W	--	
Pitt	W	W	Stone, sand and gravel.
Polk	W	W	Do.
Randolph	W	W	Stone.
Richmond	W	W	Stone, sand and gravel.
Robeson	W	W	Sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in North Carolina, by county [1]—Continued
(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Rockingham	$1,106	W	Stone, clays, sand and gravel.
Rowan	2,716	$2,776	Do.
Rutherford	W	W	Stone, sand and gravel.
Sampson	86	W	Sand and gravel, clays.
Scotland	W	9	Sand and gravel.
Stanly	W	539	Clays.
Stokes	W	W	Sand and gravel, stone, clays.
Surry	W	W	Stone, sand and gravel.
Swain	559	W	Stone.
Transylvania	W	W	Stone, sand and gravel.
Union	W	W	Stone, clays, sand and gravel.
Vance	W	W	Stone.
Wake	W	W	Stone, sand and gravel.
Washington	9	W	Sand and gravel.
Watauga	W	W	Sand and gravel, stone.
Wayne	212	337	Sand and gravel.
Wilkes	W	W	Stone, sand and gravel.
Wilson	W	W	Do.
Yadkin	2	--	
Yancey	1,031	1,427	Olivine, mica, sand and gravel, feldspar, stone, asbestos.
Undistributed [2]	r 88,996	82,501	
Total [3]	r 109,520	116,323	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Dare, Tyrrell, and Warren.

[2] Includes gem stones and values indicated by the symbol W.

[3] Data may not add to totals shown because of independent rounding.

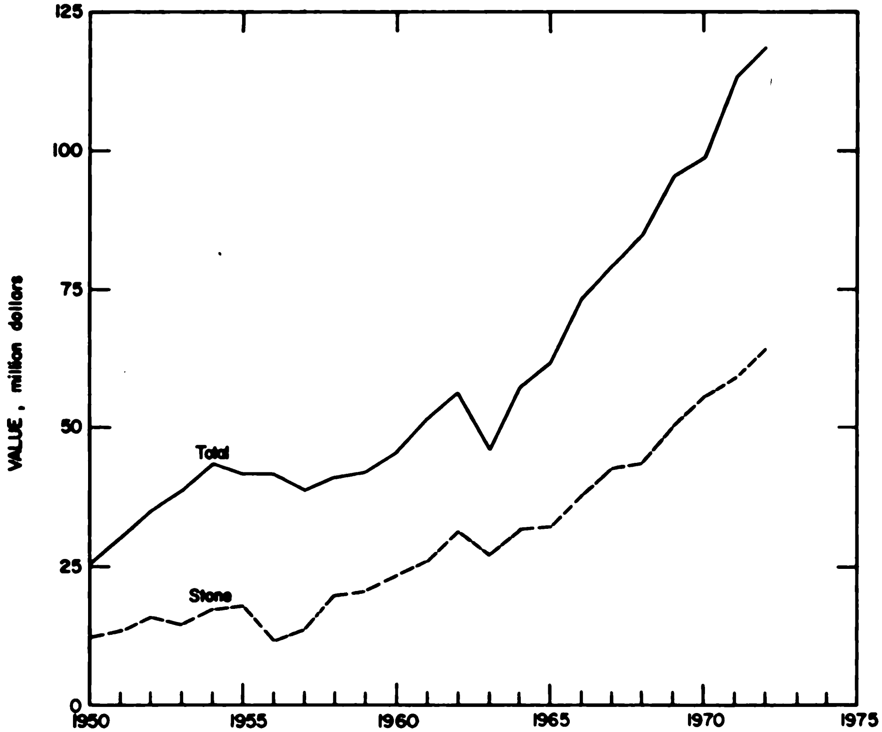

Figure 1.—Value of stone and total value of mineral production in North Carolina.

mineral-related investigations concerning North Carolina's mineral potential and industry development. One of its publications described the gold resources of North Carolina.[3] Another report described the petrography and stratigraphy of the Carolina slate belt in Union County, N. C.[4] A third publication listed the principal mineral producers of North Carolina.[5]

The Division of Mineral Resources, Office of Earth Resources, began publishing a series of mineral resource summaries of specific 7-½-minute quadrangles during the year. A geologic map and mineral resources summary was prepared for two quadrangles.[6]

The North Carolina Mining Act of 1971 became fully effective on July 1, 1972. This act requires mine operators to observe sound conservation practices and to reclaim for useful purposes all lands disturbed by mining. Permits are required for each mine where the affected land area is greater than 1 acre, and are dependent upon approved reclamation plans and Surety Bonds. The Mining Division, Office of Earth Resources, issued permits for 347 mines, bringing a total of 10,825 acres under bond. Exemptions from permit requirements were granted for 67 mines where the individual affected area was less than 1 acre. The distribution of permits by commodity and number of mines was as follows:

Clay and shale	39
Crushed stone	75
Dimension stone	18
Gem stones	16
Industrial minerals	47
Sand and gravel	152

Permits for industrial mineral mines covered agricultural limestone, asbestos, feldspar, limestone for cement, lithium minerals, mica (scrap), olivine, phosphate rock, and talc and pyrophyllite.

The Asheville Mineral Research Laboratory of North Carolina State University continued an active program of metallurgical research related to processing problems encountered by the State's mineral industry. A large portion of the research was conducted in cooperation with industry groups.

The North Carolina Marine Science Council, in cooperation with State and Federal agencies, prepared and published a preliminary planning report for marine and coastal resource development in North Carolina.[7]

The Carolina Geological Society and the Atlantic Coastal Plain Geological Association published a Field Trip Guidebook that described the relationships between the geology and geomorphology of the North Carolina Coastal Plain and their influence on the genesis and distribution of soils.[8]

During the year, the State of North Carolina acquired the site where the discovery of gold in 1779 touched off the first gold rush in United States history. In 1966, the U.S. Department of the Interior announced the eligibility of the Reed Gold Mine, Cabarrus County, for the select company of National Historic Landmarks. In that same year, the North Carolina Department of Archives and History placed the property on its list of priority acquisitions. In April 1972, Archives and History announced the acquisition of the property for development as a State historic site. The 822-acre site was obtained by a combination of purchase and a partial donation of acreage by present landowners. Archives and History, with the cooperation of the National Park Service, has prepared a master plan for the development of the property. Future plans include the construction of a visitor center on the property containing exhibits depicting gold and gold mining during the State's early history, and, if feasible, some of the old shafts and tunnels of the mine may be rehabilitated and opened to the public so that the actual gold mine workings can be visited.

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[3] Carpenter, P. A., III. Gold Resources of North Carolina. N. C. Dept. of Nat. and Econ. Res. Office of Earth Res., Div. of Miner. Res. IC 21, 1972, 56 pp.

[4] Randazzo, A. F. Petrography and Stratigraphy of the Carolina Slate Belt, Union County, North Carolina. N. C. Dept. of Nat. and Econ. Res., Office of Earth Res., Div. of Miner. Res. Spec. Pub. 4, 1972, 39 pp.

[5] Wilson, W. F. A Directory of the Principal Mineral Producers of North Carolina. N. C. Dept. of Nat. and Econ. Res., Office of Earth Res., Div. of Miner. Res. 1972, 19 pp.

[6] Butler, J. R. Geologic Map and Mineral Resources Summary of the Black Mountain Quadrangle, N.C. GM-201-SE and MRS-201-SE, 1972, 7 pp., 1 map.

Nelson, D. O. and J. L. Bundy, Geologic Map and Mineral Resources Summary of the Oteen Quadrangle, N.C. GM-201-SW and MRS-201-SW, 1972, 7 pp., 1 map.

[7] North Carolina Marine Science Council. North Carolina's Coastal Resources. A Preliminary Planning Report for Marine and Coastal Resource Development in North Carolina. Dec. 15, 1972, 218 pp.

[8] Daniels, R. B., E. E. Gamble, W. H. Wheeler, and C. S. Holzhey. Field Trip Guidebook. Carolina Geol. Soc. and Atlantic Coastal Plain Geol. Assoc. Oct. 7-8, 1972, pp. 1-36.

Trends and Developments.—According to the Commerce and Industry Division of the Department of Natural and Economic Resources, there were 157 new plants and 326 plant expansions in 1972; capital investment in new and expanded industries in the State totaled $646 million. These investments created over 26,000 new industrial jobs for the people of the State and added $151 million to the industrial payrolls.

There was considerable development within the glass industry in the State during the year. Two large glass producers announced that construction would start on new plants. Early in the year, Libby-Owens-Ford Co. announced it would build a large float-glass plant near Laurinburg, Scotland County, which would increase the company's total float-glass capacity by about 30%. The plant, to employ about 500 to 600 workers, will be operated by a new subsidiary, L-O-F Glass of Canada, Ltd. Near yearend, Owens-Illinois, Inc., of Toledo, Ohio, announced plans to construct a new glass container plant near Winston-Salem. The plant will occupy 240,000 square feet and is slated to produce more than 425 million bottles and jars annually for a variety of users. The new facility will employ about 200 people and have an annual payroll of about $2 million.

Table 3.—Indicators of North Carolina business activity

	1971	1972[p]	Change, percent
Employment and labor force, annual average:			
Total labor force.....thousands..	2,311.7	2,369.4	+2.5
Unemployment.....do....	90.9	74.1	−18.5
Employment.....do....	2,220.8	2,295.3	+3.4
Construction.....do....	96.7	99.1	+2.5
All manufacturing.....do....	715.0	735.5	+2.9
Personal income:			
Total.....millions..	$17,661	$19,403	+9.9
Per capita.....	$3,424	$3,721	+8.7
Construction activity:			
Value of private nonresidential construction.....millions..	$264.2	$358.7	+35.8
State Highway Commission:			
Value of contracts awarded.....do....	$166.1	[e] $160.0	−3.7
Cement shipments to and within North Carolina...thousand short tons	1,840	2,142	+16.4
Farm marketing receipts.....millions..	$1,541.4	$1,716.7	+11.4
Mineral production value.....do....	[r] $109.5	$116.3	+6.2
Export trade.....do....	186.0	349.5	+87.9
Import trade.....do....	322.8	449.6	+39.3

[e] Estimated. [p] Preliminary. [r] Revised.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal..........	126	283	36	285	--	30	105.08	1,622
Nonmetal..........	1,966	259	509	4,108	2	112	27.75	4,677
Sand and gravel......	912	241	220	2,079	1	38	18.76	3,978
Stone..........	2,012	237	478	4,071	3	55	14.25	4,816
Total[1]..........	5,016	248	1,242	10,542	6	235	22.86	4,510
1972:[2]								
Metal..........	20	121	2	19	--	1	51.74	1,293
Nonmetal..........	1,610	243	390	3,160	--	94	29.75	696
Sand and gravel......	550	224	123	1,120	--	20	17.86	714
Stone..........	2,080	229	477	4,103	1	47	11.70	1,727
Total..........	4,260	233	993	8,401	1	162	19.40	1,203

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Asbestos.—Amphibole asbestos was mined by Powhatan Mining Co. in Jackson and Yancey Counties. The output decreased slightly from that of 1971, both in quantity and in value.

Cement.—Ideal Cement Co. produced portland and masonry cement at its Castle Hayne plant in New Hanover County. Combined shipments of plant products decreased moderately from those of 1971, both in quantity and in value.

Three types of portland cement were produced—general use, moderate heat, and high-early strength. Shipments to ultimate consumers from plants and terminals were by truck (59%), by rail (40%), and by barge (1%). Sales of portland cement were to ready-mix concrete companies (74%), concrete product manufacturers (11%), building material dealers (4%), and contractors and other users (11%).

The apparent consumption of portland and masonry cements in North Carolina, including that imported from outside the State, was 2,137,000 tons, an increase of 16% over that of 1971.

Clays.—Common clay and shale was mined by 26 companies from 45 mines in 23 counties. Production increased 10% in quantity and 18% in value over that of 1971. Sixteen mines in Chatham, Lee, Rockingham, and Stanly Counties accounted for 59% of the State's production in quantity and 51% in value. The leading common clay and shale producers by quantity were Boren Clay Products Co., Pine Hall Brick and Pipe Co., Sanford Brick Corp., and Solite Corp. Together, their 13 operations produced 50% of the common clay and shale by quantity and 42% by value.

Seventy percent of the common clay and shale was consumed by 22 companies in manufacturing face brick. The leading producers were Boren Clay Products Co., Pine Hall Brick and Pipe Co., and Sanford Brick Corp. Together, they consumed nearly one-half of the common clay and shale used for this purpose. Other major uses for common clay and shale, in descending order, were lightweight aggregate, cement, common brick, and sewer pipe. Relatively small amounts were used for the manufacture of structural tile and drain tile.

North Carolina has been the Nation's leading brick producer since 1962 and continued this position through the current year. In 1972 it manufactured 1.2 billion brick valued at $47.1 million for 15% of the total U.S. production. Approximately 3,000 people were employed by the brick industry with a payroll of $18 million. Natural gas used at the plants cost $3.5 million. A publication described the development of North Carolina's brick industry, including improvements in technology.[9]

North Carolina's brickmakers, moving to meet the building trade's increasing demand for their product, increased production capacity by 100 million brick during the year. Triangle Brick Co., Durham, N.C., announced that it was constructing a new plant in Wake County, which would increase the company's capacity by 50%, from 70 million to 105 million brick per year. The new plant will be completedly automated and employ 30 persons. Other expansions announced included a $3 million expansion of Pomona Corp's vitrified clay pipe plant at Gulf, near Sanford. The new facilities will permit the company to make 15- and 18-inch sizes of pipe, where in the past the pipe was made only in diameters of 4 to 12 inches. The company will also add a third kiln at the Gulf plant. Statesville Brick Co., near Statesville, announced a $1.5 million expansion, which will double that company's current output to 250,000 brick per day. Facilities will include a new main building and new kilns and dryers. Pine Hall Brick and Pipe Co., near Madison, announced that it was installing a new kiln.

Harris Mining Co., with two mines in Avery County, was the sole producer of waterwashed kaolin. Kings Mountain Mica Co., Inc. produced unprocessed kaolin at a mine in Cleveland County. The combined output of waterwashed and unprocessed kaolin increased substantially in quantity and moderately in value from that of 1971. The waterwashed kaolin was used mainly in the manufacture of sanitary ware, and the unprocessed kaolin was used largely in the production of face brick.

There was no production of fire clay in North Carolina in 1972.

Feldspar.—North Carolina ranked first in

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[9] Wachovia. North Carolina's Brick Industry: No. 1. V. 60, No. 2, 1973, pp. 18–20.

Table 5.—North Carolina: Common clay and shale sold or used by producers, by county
(Short tons)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Catawba	1	18,328	$17,400	1	24,673	$27,200
Chatham	4	586,298	588,690	4	630,630	718,367
Cumberland	1	12,705	27,810	1	14,750	29,500
Davidson	1	W	58,500	1	104,000	93,600
Guilford	3	98,729	98,729	3	122,125	134,400
Harnett	5	W	W	4	79,243	89,600
Henderson	2	88,000	W	2	60,000	66,000
Iredell	1	18,328	17,400	1	24,673	27,200
Lee	5	457,538	442,538	4	548,323	581,550
Rockingham	5	W	W	5	571,801	423,301
Rowan	2	W	W	2	99,026	109,000
Sampson	1	37,035	37,035	1	43,252	47,600
Stanly	3	W	W	3	527,669	539,000
Stokes	--	--	--	1	4,719	2,360
Union	1	211,072	W	1	197,564	494,000
Undistributed [1]	11	1,974,846	2,513,667	11	809,987	1,090,505
Total	46	3,502,879	3,801,769	45	3,862,435	4,473,183

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Alamance, Cabarrus, Cleveland, Durham, Halifax, Montgomery, Moore, New Hanover, and data indicated by symbol W.

the production of feldspar, accounting for 60% of U.S. production in quantity and 58% in value. State production increased 12% in quantity and 29% in value above that of 1971. Six companies operated nine mines in Cleveland, Mitchell, and Yancey Counties. The leading producers were International Minerals & Chemical Corp., Lawson-United Feldspar and Mineral Co., and The Feldspar Corp. Production was mainly in the form of flotation concentrate; there was only minor production of feldspar silica mix and hand-cobbed feldspar, in that order.

Five feldspar producers operated six feldspar grinding plants in Cleveland and Mitchell Counties. Ground feldspar shipments increased 12% in quantity and 28% in value over those of 1971. The major demand for feldspar was in the glass industry, followed by pottery manufacturing. The main destinations of ground feldspar shipments were Ohio (13%), Illinois (10%), Tennessee (9%), West Virginia (8%), and Texas (6%). The remaining 54% of the shipments went to numerous States, none of which accounted for more than 5% each.

Gem Stones.—Amateur collectors of gems and minerals were responsible for the production of precious and semiprecious stones in several areas of the State. Some of the better known gem stones are emeralds, rubies, agates, garnets, tourmalines, and sapphires. Among the lesser known are zircons and rutilated quartz. A publication described the occurrences of gem stones in North Carolina.[10]

Lithium Minerals.—Two producing mines in North Carolina accounted for the major portion of U.S. lithium production in 1972. Foote Mineral Co. operated a mine and mill at Kings Mountain, Cleveland County. The concentrate was shipped outside the State for further processing. Lithium Corp. of America, Inc., operated a mine and lithium chemicals plant near Bessemer City, Gaston County. State production was slightly more in both quantity and value than in 1971.

Foote Mineral Co. began construction of a new plant to produce low-iron spodumene at its Kings Mountain operation. The plant, slated to become operational in early 1973, will supply low-iron lithium for use in glass, glazes, enamels, heat-resistant bodies and glass-ceramics. Low-iron spodumene is the most recent addition to Foote's product line and represents the culmination of many years of research and development.

Mica.—The State accounted for 57% of the domestic production of scrap mica by quantity and 68% by value. State production increased 36% in quantity and 66% in value over that of 1971. Eight companies reported production of scrap mica from 12 mines in Avery, Cleveland, Mitchell, and

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[10] Grigg, J. S. Rockhounding in the Old Smokies. Gems and Miner., May 1973, pp. 29–31.

Yancey Counties. Leading producers were Deneen Mica Co., Inc., Harris Mining Co., Kings Mountain Mica Co., Inc., The Feldspar Corp., and U.S. Gypsum Co. Together, their nine operations accounted for 85% of the scrap mica production by quantity and 92% by value. There was no production of sheet mica during 1972.

Ground mica was produced by seven companies with nine plants in Buncombe, Cleveland, Macon, Mitchell, and Yancey Counties. Six plants used dry methods, two used wet methods, and one used both methods. Ground mica output increased 4% in both quantity and value above that of 1971. The leading producers were Deneen Mica Co., Inc., Diamond Mica Co., Harris Mining Co., and the English Mica Co. Together, their six operations accounted for 82% of the ground mica production by quantity and 79% by value.

The major uses for ground mica were for joint cement, paint, roofing, rubber, and well drilling. Together, these uses accounted for 97% of the output by quantity and 94% by value.

Table 6.—North Carolina: Ground mica sold or used by producers, by use

Use	1971			1972		
	Quantity (short tons)	Value		Quantity (short tons)	Value	
		Total	Average per ton		Total	Average per ton
Roofing	W	W	W	13,528	$489,408	$36.18
Paint	12,500	$1,709,394	$136.75	10,485	1,693,382	161.51
Rubber	5,284	875,534	165.70	5,564	W	W
Wallpaper	W	W	W	492	79,150	160.87
Plastics	344	W	W	357	W	W
Other uses [1]	38,053	1,868,996	49.12	27,978	2,361,917	84.42
Total	56,181	4,453,924	79.28	58,404	4,623,857	79.17

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes joint cement, textile coating, well drilling, and other uses, and uses indicated by symbol W.

Olivine.—International Minerals & Chemical Corp. mined and beneficiated olivine in Yancey County. The output was slightly more than that in 1971, both in quantity and value. The material was used for molding sand.

Perlite.—There was no production of expanded perlite in 1972. In prior years, one company expanded perlite using crude material imported from other States.

Phosphate Rock.—The production of phosphate rock at the Lee Creek fertilizer complex of Texas Gulf, Inc., Beaufort County, decreased slightly in quantity and increased slightly in value from that of 1971. The major portion of the output was used for producing phosphoric acid, triple superphosphate, and diammonium phosphate. Only a relatively small quantity was exported as phosphate rock.

Phosphoric acid production at the Lee Creek fertilizer complex was 24% more than that of 1971. As a result of the record production of phosphoric acid, the production of dry fertilizers was 44% more than that in 1971. An expansion of phosphoric acid production capacity from 340,000 short tons to 510,000 tons per year was in progress and was expected to be completed by January 1974. The $23 million project will add a third sulfuric acid and phosphoric acid unit to the two existing units for each product. The long-range plan was to increase the capacity of the phosphoric acid plants from 510,000 tons to 1 million tons per year over the next few years.[11]

The Agricultural Division, Texas Gulf, Inc., moved into a new building in Raleigh, N. C., on September 1, 1972. It was the first building to bear the new company name. In addition to the executive and marketing headquarters of the Agricultural Division, the building houses the company's corporate data processing center, which moved from New York City. This unit will serve all of the company's operations in the United States.

Sand and Gravel.—Sand and gravel continued to be the second leading mineral commodity produced in the State. Production was reported by 104 commercial and 65 Government-and-contractor operations located in 79 counties. The combined output declined by 5% in quantity and 1% in value below that of 1971 because of a de-

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[11] Texas Gulf, Inc., 1972 Annual Report. Lee Creek Operations. P. 7.

Table 7.—North Carolina: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Alexander	1	25	11	1	18	3
Ashe	2	W	W	1	50	90
Avery	2	W	W	3	W	191
Brunswick	4	45	10	1	50	11
Buncombe	3	W	W	4	W	408
Caldwell	3	W	W	1	12	6
Camden	1	9	2	1	9	2
Carteret	1	10	3	1	10	3
Caswell	1	5	2	--	--	--
Catawba	4	W	W	6	111	107
Chowan	1	19	5	1	20	5
Columbus	4	111	86	1	19	2
Currituck	1	38	9	1	39	10
Davie	3	W	W	3	65	33
Duplin	5	W	W	5	101	W
Edgecombe	11	333	273	9	298	285
Forsyth	2	63	44	1	65	45
Franklin	3	W	W	1	7	W
Gates	1	23	6	1	23	6
Granville	1	1	(1)	--	--	--
Greene	2	93	49	3	W	W
Halifax	1	64	24	1	62	12
Harnett	8	2,436	3,172	5	2,753	3,959
Hertford	2	183	116	2	W	185
Hoke	1	55	6	1	57	6
Hyde	1	19	5	1	20	5
Iredell	5	W	W	3	178	W
Jones	1	21	6	1	W	W
Lee	2	W	W	3	210	W
Lincoln	1	30	22	1	32	24
McDowell	5	361	405	3	W	W
Macon	--	--	--	2	38	38
Martin	1	4	1	1	4	1
Montgomery	1	32	13	1	W	W
Moore	7	807	505	5	578	223
Nash	1	34	2	1	35	2
New Hanover	4	15	3	1	17	4
Onslow	4	8	3	1	10	3
Pamlico	1	12	3	1	13	4
Pasquotank	1	45	11	1	46	12
Pender	4	35	8	1	38	9
Perquimans	1	20	5	1	20	5
Pitt	6	566	248	5	538	256
Polk	4	14	6	1	12	5
Richmond	3	W	W	2	63	437
Rockingham	3	W	W	6	118	114
Rutherford	1	158	79	1	122	61
Sampson	6	96	49	6	W	W
Scotland	2	W	W	1	25	9
Stokes	5	90	63	1	93	65
Surry	3	4	7	3	W	W
Union	1	26	23	1	27	24
Wake	1	3	3	1	W	W
Washington	1	36	9	2	W	W
Watauga	3	W	W	1	W	427
Wayne	8	355	212	5	345	337
Wilkes	1	4	2	3	W	W
Wilson	2	42	9	2	62	W
Yadkin	1	2	2	1	(1)	(1)
Undistributed [2]	[r] 74	7,890	9,221	45	7,072	7,171
Total [3]	233	14,240	14,690	169	13,485	14,615

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[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Alamance, Anson, Beaufort, Bertie, Bladen, Burke, Cabarrus, Cleveland, Craven, Cumberland, Davidson, Gaston, Guilford, Haywood, Jackson, Johnston, Lenoir, Northampton, Person (1971), Robeson, Rowan, Transylvania (1972), and Yancey Counties, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

Table 8.—North Carolina: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,912	3,945	4,546	4,878
Fill	381	200	195	148
Paving	1,893	1,709	2,065	1,722
Gravel:				
Building	1,438	3,016	1,224	2,422
Paving	1,748	2,537	1,097	1,431
Other sand and gravel [1]	817	1,900	945	2,600
Total [2]	10,191	13,305	10,072	13,203
Government-and-contractor operations:				
Sand:				
Building	4	2	--	--
Fill	572	57	130	19
Paving	2,237	889	2,035	892
Other uses	777	258	696	210
Total [2]	3,590	1,207	2,861	1,121
Gravel: Paving	460	178	552	292
Total	460	178	552	292
Total sand and gravel [2]	14,240	14,690	13,485	14,615

[1] Includes filtration (1972), fire and furnace (1972), railroad ballast, other sands, fill, miscellaneous and other gravel.

[2] Data may not add to totals shown because of independent rounding.

crease in production by Government-and-contractor operations.

Commercial sand and gravel comprised 75% of the total State production by quantity and 90% by value. Eighteen commercial operations in Anson, Buncombe, Cumberland, Harnett, and Moore Counties accounted for 67% of the commercial production by quantity. The leading commercial sand and gravel producers were Becker Sand & Gravel Co., W. R. Bonsal Co., Inc., B. V. Hedrick Sand and Gravel Co., and Nello L. Teer Co. Together, their eight operations accounted for 48% of the commercial sand and gravel production by quantity, and 57% by value.

Commercial operations provided all of the sand and gravel used for building purposes and 55% of that used for paving. Transportation of commercial sand and gravel was 67% by truck, 32% by railroad, and 1% by waterway.

Gifford-Hill and Company, Inc., a construction materials firm based in Dallas, Tex., acquired Becker Sand & Gravel Co., a large sand and gravel producing company with operations in both North and South Carolina. Becker, with headquarters in Cheraw, S.C., operates three open pit mines in Cumberland, Harnett and Moore Counties.

Stone.—Stone was again the principal mineral commodity produced in the State. The output increased 4% in quantity and 8% in value over that of 1971. Production was reported from 55 counties by 42 commercial producers with 108 quarries, and the State Highway Commission's one quarry. Twenty-four large quarries, with individual outputs of more than 500,000 tons, accounted for 69% of the State's total stone production by quantity. A total of 17 operations in Forsythe, Guilford, Mecklenburg, New Hanover, and Wake Counties produced 38% of the stone by quantity and 36% by value. The leading stone producers by quantity were Central Rock Co., Inc., Ideal Cement Co., Martin Marietta Aggregates (formerly Superior Stone Co.), Nello L. Teer Co., and Vulcan Materials Co. Together, their 48 operations accounted for 86% of the stone production by quantity and 81% by value.

The production of crushed granite at 69 quarries accounted for 81% of the State's stone output by quantity, and 74% by value. Production increased 9% in quantity and 12% in value over that of 1971.

Table 9.—North Carolina: Crushed granite sold or used by producers, by county

(Short tons and thousand dollars)

County	1971			1972		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Avery	--	--	--	1	40,892	74
Cabarrus	1	73,420	73	1	73,420	73
Clay	--	--	--	1	27,016	33
Haywood	1	W	W	1	20,000	W
Jackson	2	W	W	1	W	240
Madison	--	--	--	1	150,000	227
Richmond	2	W	W	2	283,646	W
Surry	3	727,128	1,066	2	W	W
Undistributed [1]	67	23,159,633	40,407	59	25,516,998	45,968
Total	76	23,960,181	41,546	69	26,111,972	46,615

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Alamance, Alleghany, Ashe (1971), Buncombe, Burke, Caldwell (1971), Caswell, Catawba, Chatham, Cleveland, Davidson, Davie (1971), Forsyth, Gaston, Graham, Granville, Guilford, Halifax (1971), Henderson, Iredell, Johnston (1971), Lee, Mecklenburg, Mitchell, Moore, Nash, Orange, Pitt, Polk, Randolph, Richmond, Rockingham, Rowan, Rutherford, Stokes, Swain (1971), Transylvania, Union, Vance, Wake, Watauga (1972), Wilkes, Wilson, and Yancey (1972), Counties.

Major quantities of other types of crushed and broken stone were produced at eight limestone and three traprock operations. Relatively minor outputs were reported by one marble, one marl, two quartz, four sandstone, and two miscellaneous rock operations. Combined, they accounted for 19% of the State's stone production in both quantity and value. The production of these categories of stone declined 11% in quantity and 5% in value below that of 1971.

The major uses for crushed and broken stone were as roadbase and surfacing material (65%), bituminous and macadam aggregate (15%), concrete aggregate (13%), and other uses (7%). Transportation was predominantly by truck (93%), railroad (6%), and waterway (1%).

The production of dimension stone was reported by 15 granite, two slate, and three individual marble, quartzite, and sandstone quarries. Granite dimension stone accounted for 86% of dimension stone by quantity and 88% by value. The total tonnage of dimension stone produced was small, amounting to less than 0.2% of the State's stone production, but the value accounted for 7% of the State total for stone. The output increased by 3% in quantity and 7% in value above that of 1971.

The corporate name of Superior Stone Co., North Carolina's largest stone producer, was changed to Southeast Division, Martin Marietta Aggregates. Superior Stone Co. was formerly a subsidiary of Martin Marietta.

Talc and Pyrophyllite.—The production of talc and pyrophyllite increased 5% in quantity and 14% in value over that of 1971. Talc was produced by Hitchcock Corp. in Cherokee County. The main uses were for toilet preparations and in the textile industry. Pyrophyllite was produced by four companies operating six mines in Alamance, Granville, Moore, and Orange Counties. The major part of the production was used, in descending order, by the refractory, ceramic and insecticide industries. Leading producers were Piedmont Minerals Co., Inc., in Orange County, and Standard Minerals Co., Inc., in Moore County.

At the end of the year, General Minerals Co., a long-time producer of pyrophyllite and other minerals in the State, closed all operations, including its Greensboro office. The company has had continuous mineral production in the State for 50 years.

Vermiculite.—W. R. Grace & Co. operated an exfoliating plant in Guilford County, and Carolina Wholesale Florist, Inc., operated a plant in Lee County. Both companies used crude vermiculite shipped into the State. The combined output was moderately greater than in 1971, both in quantity and value. The principal uses for the finished product were as insulation (76%), aggregate (18%), and other uses (6%).

METALS

Aluminum.—Primary aluminum was produced by the Aluminum Co. of America (Alcoa) at a plant near Badin, in Stanly County, using imported alumina. The production decreased slightly in quantity and moderately in value below that of 1971.

Copper.—The Old Ore Knob Copper Mine, near West Jefferson, Ashe County, was sold about mid-year by Mineco Equipment Corp. of Toronto, Canada, to a group of North Carolina businessmen. The mine property, whose production history goes back to the 1870's, consists of a 692-acre mine site, mineral rights to an additional 2,900 acres and surface buildings. The mine has been inactive since 1962, when it was closed by Nipissing Mines Co., Ltd., of Toronto and reportedly sold.

Iron Ore.—Greenback Industries, Inc., operated the Cranberry mine and concentrator in Avery County. The production was in the form of a high-quality magnetite product for special uses. The output increased slightly in quantity and decreased slightly in value from that of 1971.

Tungsten.—There was no production of tungsten in North Carolina during 1972, as the sole producer in Vance County suspended operations in August 1971 because of a sharp decline in tungsten prices. The owner, Ranchers Exploration and Development Corp., kept the underground mine dewatered and the mill in standby condition, pending an improvement in tungsten prices.

MINERAL FUELS

There was no production of mineral fuels in North Carolina during 1972.

Petroleum and Natural Gas.—Three exploratory wells were drilled in North Carolina during 1972; all were dry and subsequently abandoned. The depths of the holes ranged from 1,950 to 4,319 feet, for a total footage drilled of 9,852 feet. Two wells were drilled in Tyrrell County, with a total footage of 7,902 feet and one well in Carteret County to a depth of 1,950 feet.

Leases for oil and gas exploration on State-owned submerged lands were continued by Cities Service Oil Company in the northeastern Coastal Plain region, and Colonial Oil and Gas Company in the southeastern Coastal Plain region.

Table 10.—Principal producers

Commodity and company	Address	Type of activity	County
Aluminum: Aluminum Company of America.	1501 Alcoa Bldg. Pittsburgh, Pa. 15219	Smelter	Stanly.
Asbestos: Powhatan Mining Co	6721 Windsor Mill Road Baltimore, Md. 21207	Open pit mine	Jackson and Yancey.
Cement: Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Plant	New Hanover.
Clays:			
Kaolin: Harris Mining Co	Box 628 Spruce Pine, N.C. 28777	Open pit mine and plant.	Avery.
Miscellaneous:			
Boren Clay Products Co	Pleasant Garden, N.C. 27313	4 open pit mines and plants.	Chatham, Guilford, Sampson.
Carolina Solite Corp	Box 9138 Richmond, Va. 23227	Open pit mine and plant.	Stanly.
Pine Hall Brick and Pipe Co	Box 4325, North Station Winston-Salem, N.C. 27105	4 open pit mines and plants.	Rockingham.
Sanford Brick Corp	Box 38 Gulf, N.C. 27256	8 open pit mines and plant.	Chatham, Lee, Stanly.
Solite Corp	Box 9138 Richmond, Va. 23227	Open pit mine and plant.	Rockingham.
Feldspar:			
The Feldspar Corp.[1]	Spruce Pine, N.C. 28777	8 open pit mines and 2 plants.	Mitchell.
Foote Mineral Co	Box 792 Kings Mountain, N.C. 28086	Open pit mine and plant.	Cleveland.
International Minerals & Chemical Corp.[1]	Old Orchard Road Skokie, Ill. 60079	Open pit mine and 2 plants.	Mitchell.
Kings Mountain Silica Co., Inc	Box 709 Kings Mountain, N.C. 28086	2 open pit mines and 2 plants.	Cleveland.
Lawson-United Feldspar and Mineral Co.[1]	Minpro, N.C. 28777	Open pit mine and plant.	Mitchell.
Iron ore: Cranberry Magnetite Division, Greenback Industries.	Box 63 Greenback, Tenn. 37742	Underground mine and plant.	Avery.
Lithium minerals:			
Foote Mineral Co	Box 792 Kings Mountain, N.C. 28086	Open pit mine and plant.	Cleveland.
Lithium Corp. of America, Inc	Box 428 Bessemer City, N.C. 28016	----do	Gaston.

See footnote at end of table.

Table 10.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Mica, scrap:			
Deneen Mica Co., Inc	Newdale, N.C. 28714	Open pit mine and plant.	Yancey.
Harris Mining Co	Box 628 Spruce Pine, N.C. 28777	3 open pit mines and 2 plants.	Avery and Mitchell.
Kings Mountain Mica Co., Inc	Box 709 Kings Mountain, N.C. 28086	2 open pit mines and 2 plants.	Cleveland.
Mica, grinders:			
Deneen Mica Co., Inc	Newdale, N.C. 28714	Open pit mine and plant.	Yancey.
Diamond Mica Co	Box 648 Spruce Pine, N.C. 28777	Plants	Mitchell and Yancey.
The English Mica Co	Ridgeway Center Bldg. Stamford, Conn. 06905	Plant	Cleveland.
Harris Mining Co	Box 628 Spruce Pine, N.C. 28777	2 open pit mines and 2 plants.	Mitchell.
Olivine:			
Northwest International	Box 672 Spruce Pine, N.C. 28777	Open pit mine and plant.	Yancey.
Perlite, expanded: Carolina Perlite Co., Inc.	Box 741 Hillside, N.J. 07205	Plant	Rowan.
Phosphate rock: Texas Gulf, Inc	200 Park Avenue New York, N.Y. 10017	Open pit mine and plant.	Beaufort.
Sand and gravel:			
Becker Sand & Gravel Co	Box 848 Cheraw, S.C. 29520	3 open pit mines	Cumberland, Harnett, Moore.
W. R. Bonsal Co., Inc	Box 38 Lilesville, N.C. 28091	Open pit mine	Anson.
Grove Stone and Sand, Branch of B. V. Hedrick Gravel and Sand Co.	Swannanoa, N.C. 28778	do	Buncombe.
Lessees of B. V. Hedrick Gravel and Sand Co.	Lilesville, N.C. 28091	do	Anson.
Nello L. Teer Co	Box 1131 Durham, N.C. 27702	do	Harnett.
Stone:			
Granite, crushed:			
Central Rock Co., Inc	Box 510 Greensboro, N.C. 27409	Quarry	Guilford.
Foote Mineral Co	Box 792 Kings Mountain, N.C. 28086	Open pit mine	Cleveland.
Franklin Stone Co	P.O. Box 696 Franklin, N.C. 28734	Quarry	Macon.
Martin-Marietta Aggregates	Box 2479 Raleigh, N.C. 27602	24 quarries	Alamance, Catawba, Chatham, Cleveland, Davidson, Guilford, Halifax, Iredell, Mecklenburg, Moore, Pitt, Randolph, Rockingham, Rowan, Union, Wake.
Nello L. Teer Co	Box 1131 Durham, N.C. 27702	5 quarries	Granville, Nash, Wake, Wilson.
Vulcan Materials Co	Box 7506, Reynolds Station, Winston-Salem, N.C. 27106	15 quarries	Buncombe, Caldwell, Caswell, Davie, Forsyth, Granville, Guilford, Haywood, Henderson, Rockingham, Surry, Vance, Wilkes.

See footnote at end of table.

Table 10.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Granite, dimension:			
Comolli Granite Co	Elberton, Ga. 30635	2 quarries	Rowan.
Harris Granite Quarries Co	P.O. Box 1038 Salisbury, N.C. 28144	do	Do.
North Carolina Granite Corp	Box 151 Mt. Airy, N.C. 27030	Quarry	Surry.
Troitino and Brown, Inc	Box 5595 Asheville, N.C. 28803	do	Avery.
Limestone, crushed:			
Fletcher Limestone Co., Inc	Box 98 Fletcher, N.C. 28732	do	Henderson.
Ideal Cement Co	420 Ideal Cement Bldg. Denver, Colo. 80202	do	New Hanover.
Martin-Marietta Aggregates	Box 2479 Raleigh, N.C. 27602	2 quarries	Cleveland.
Marble, crushed and dimension:			
Moretti-Harrah Marble Co	Box 330 Sylacauga, Ala. 35150	Quarry	Cherokee.
Slate, dimension:			
Jacob's Creek Stone Co., Inc	P.O. Box 608 Denton, N.C. 27239	2 quarries	Davidson and Montgomery.
Sandstone, crushed:			
The Feldspar Corp	Spruce Pine, N.C. 28777	2 open pit mines	Mitchell.
Sandstone, dimension:			
Jacob's Creek Stone Co., Inc	P.O. Box 608 Denton, N.C. 27239	Quarry	Montgomery.
Shell, crushed and broken:			
Superior Stone Co	Box 2568 Raleigh, N.C. 27602	3 quarries	Craven, New Hanover, Onslow.
Traprock, crushed:			
Nello L. Teer Co	Box 1131 Durham, N.C. 27702	Quarry	Durham.
Talc and pyrophyllite:			
Pyrophyllite:			
Boren & Harvey, Inc	Box 7247 Greensboro, N.C. 27407	Open pit mine	Granville.
Glendon Pyrophyllite	Box 306 Carthage, N.C. 28327	4 open pit mines and plant.	Alamance and Moore.
Piedmont Minerals Co., Inc	P.O. Box 7247 Greensboro, N.C. 27407	Open pit mine and plant.	Orange.
Standard Minerals Co., Inc	Robbins, N.C. 27325	do	Moore.
Talc: Hitchcock Corp	Box 35 Murphy, N.C. 28906	Underground mine and plant.	Cherokee.
Vermiculite, expanded:			
Carolina Wholesale Florists, Inc	Box 537 Sanford, N.C. 27330	Plant	Lee.
W. R. Grace & Co., Construction Production Div.	62 Whittemore Avenue Cambridge, Mass. 02140	do	Guilford.

[1] Also feldspar grinding.

The Mineral Industry of North Dakota

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the State Geological Survey of North Dakota under a cooperative agreement for collecting information on all minerals except fuels.

By Joseph B. Huvos[1]

The total value of mineral production in North Dakota was $98.1 million in 1972, a decline of 1.8% from that of 1971. The value of fossil fuel production, excluding natural gas liquids, was $86.5 million, $1.5 million less than that of 1971. Changes in value in 1972, in million dollars, were as follows: crude petroleum decreased 3.2, lignite increased 1.8, and natural gas decreased 0.2.

The total value of sand and gravel output, the only major nonmetallic mineral value publishable, was $5.8 million, $0.4 million less than that of 1971. Among items the value of which was withheld, the value of natural gas liquids decreased 4%; that of clays, 9%; lime, 3%; stone, 95%; the value of salt increased 97%. No peat was produced in 1972.

Legislation and Government Programs.—In 1972, no bills of interest to the North Dakota mineral industry were signed into law. There were however, several bills in various stages of processing. The North Dakota Senate passed and sent to the House a bill on reclamation of strip mined areas.

One of two other bills that imposed a severance tax on coal was rejected by the Senate. The Senate Business, Industry and Labor Committee recommended that a bill imposing a 5% tax on coal be rejected so that the bill imposing a 5¢-per-ton tax could be passed. The Senate rejected the 5% bill and passed the 5¢ bill.

There were several Federal and State government publications issued in 1972 that could be of interest to the mineral industry.[2]

Employment and Injuries.—Statistics on employment and injuries in the mineral industries, exclusive of the petroleum industry, are presented in table 4. Information for 1971 data is final data; that for 1972 is preliminary.

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[1] Foreign mineral specialist, Division of Fossil Fuels, Assistant Directorate—Mineral Supply.

[2] Arndt, B. M. Environmental Geology and North Dakota. NDGS Misc. Series MS–48, 1972.

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Feldmann, R. M. Stratigraphy and Paleoecology of the Fox Hills Formation (Upper Cretaceous) of North Dakota. NDGS Bull. B–61, 1972.

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Kube, W. R., and J. L. Elder. Technology and Use of Lignite. BuMines IC 8543, 1972, 145 pp.

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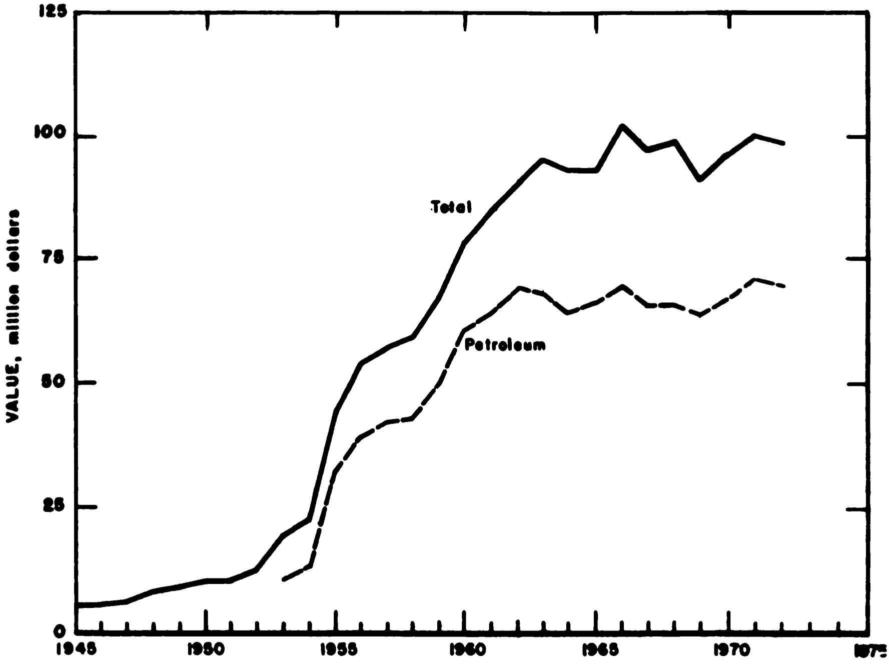

Figure 1.—Value of petroleum and total value of mineral production in North Dakota.

Table 1.—Mineral production in North Dakota [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Coal .... thousand short tons	6,075	$11,580	6,632	$13,416
Gem stones	NA	2	NA	2
Natural gas .... million cubic feet	33,864	5,655	32,472	5,455
Petroleum (crude) .... thousand 42-gallon barrels	21,653	70,805	20,624	67,647
Sand and gravel .... thousand short tons	8,196	6,210	6,681	5,757
Value of items that cannot be disclosed: Clays, lime, natural gas liquids, peat (1971), pumice (1972), salt, stone	XX	5,649	XX	5,809
Total	XX	99,901	XX	98,086
Total 1967 constant dollar	XX	84,946	XX	p 81,598

p Preliminary. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in North Dakota, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	$61	W	Coal.
Barnes	42	$161	Sand and gravel.
Benson	56	--	
Billings	5,477	6,094	Petroleum.
Bottineau	9,337	W	Petroleum, sand and gravel.
Bowman	3,494	3,710	Petroleum, coal, sand and gravel.
Burke	7,021	7,949	Petroleum, coal, natural gas liquids, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in North Dakota, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Burleigh	W	W	Sand and gravel.
Cass	W	W	Do.
Cavalier	W	W	Do.
Dickey	$43	W	Sand and gravel, stone.
Divide	879	W	Petroleum, sand and gravel.
Dunn	49	$39	Petroleum.
Eddy	W	W	Sand and gravel.
Emmons	27	--	
Foster	55	W	Sand and gravel.
Golden Valley	220	308	Petroleum, sand and gravel, stone.
Grand Forks	334	114	Sand and gravel.
Grant	33	W	Coal, sand and gravel.
Griggs	7	10	Sand and gravel.
Hettinger	W	--	
Kidder	W	W	Sand and gravel.
Logan	W	W	Do.
McHenry	W	W	Petroleum, sand and gravel.
McIntosh	W	W	Sand and gravel.
McKenzie	14,136	18,140	Petroleum, sand and gravel, pumice.
McLean	W	W	Sand and gravel, coal.
Mercer	5,515	6,677	Coal, pumice.
Morton	348	W	Clays, sand and gravel.
Mountrail	W	1,466	Petroleum.
Nelson	W	--	
Oliver	W	W	Coal, sand and gravel.
Pembina	W	800	Lime, sand and gravel.
Pierce	30	W	Sand and gravel.
Ramsey	W	--	
Ransom	136	W	Sand and gravel.
Renville	5,581	5,810	Petroleum, sand and gravel.
Richland	371	81	Sand and gravel.
Rolette	W	W	Do.
Sargent	--	W	Stone.
Sheridan	W	W	Sand and gravel.
Slope	W	397	Petroleum, sand and gravel.
Stark	6,346	4,591	Petroleum, coal, sand and gravel, clays.
Steele	W	W	Sand and gravel.
Stutsman	W	W	Sand and gravel, stone.
Towner	W	W	Sand and gravel.
Traill	133	226	Do.
Walsh	183	117	Do.
Ward	3,537	2,990	Petroleum, coal, sand and gravel.
Wells	W	--	
Williams	17,266	20,469	Petroleum, natural gas liquids, salt, sand and gravel, coal.
Undistributed [2]	19,184	22,936	
Total	99,901	[3] 98,086	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] La Moure and Sioux Counties are not listed because no production was reported.

[2] Includes gem stones, some sand and gravel, natural gas, and natural gas liquids (1971) that cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data does not add to total shown because of independent rounding.

Table 3.—Indicators of North Dakota business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force__________thousands__	261.5	272.1	+4.0
Employment__________do____	249.0	259.5	+4.2
Unemployment__________do____	12.5	12.6	+0.8
Nonagricultural employment__________do____	167.6	176.7	+5.4
Mining__________do____	1.6	1.6	--
Construction__________do____	10.4	11.9	+14.4
Manufacturing__________do____	10.2	10.7	+4.9
Government__________do____	49.3	50.0	+1.4
Transportation and public utilities__________do____	12.3	12.3	--
Wholesale and retail trade__________do____	45.0	48.6	+8.0
Finance, insurance, and real estate__________do____	7.2	7.3	+1.4
Services__________do____	31.8	34.3	+7.9
Personal income:			
Total__________millions__	$2,222	$2,350	+5.8
Per capita__________	$3,538	$3,718	+5.1
Construction activity:			
Highway construction contracts awarded__________millions__	$34.6	e $40.0	+15.6
Cement shipments to and within North Dakota__thousand short tons__	286	319	+11.5
Value of authorized nonresidential construction__________millions__	$18.1	$31.5	+74.0
Number of authorized residential units__________	3,123	3,934	+26.0
Farm marketing receipts__________millions__	$977.0	$1,107.8	+13.4
Mineral production value__________do____	$99.9	$98.1	−1.8

e Estimated. p Preliminary.

Source: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal__________	278	235	65	518	--	19	36.68	NA
Nonmetal________	16	84	1	11	--	--	--	--
Sand and gravel__	535	134	71	648	--	14	21.60	452
Stone__________	4	233	1	7	--	--	--	--
Total__________	833	167	[1] 139	1,184	--	33	27.86	NA
1972 [2]								
Coal__________	NA	NA	NA	NA	NA	NA	NA	NA
Nonmetal________	10	227	2	16	--	3	183.82	368
Sand and gravel__	200	162	33	292	--	8	27.42	665
Stone__________	--	--	--	--	--	--	--	--
Total__________	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data does not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Lignite).—At the 15 operating strip mines, each producing more than 1,000 salable short tons annually, production was 6.6 million tons in 1972, valued at an average of $2.00 per ton, an increase of 11¢ per ton. In 1972, an estimated 22.9 million cubic yards of overburden was stripped. The overburden ranged from 25 to 70 feet in thickness above the 6- to 16-foot thick coal seams. Three mines, each producing over 1 million tons per year, delivered a total of 4.01 million tons in 1972. Seven mines producing between 100,000 and 1 million tons annually, collectively produced 2.58 million tons. The other five mines, each with less than 100,000 tons, produced the remainder. All production was sold in the open market. Of the total shipments, 3,223,584 tons were by rail; 203,258 tons were by truck; 3,156,962 tons were used at mine-mouth powerplants; and

66,418 tons were shipped by other methods.

Stripmining equipment included 22 power shovels and 14 draglines, of which 31 were electric or diesel powered. Four shovels and four draglines each had buckets with over a 16-cubic-yard capacity. Carryall scrapers totaled 15, of which six were rated at over 16 cubic yards. Other equipment included one vertical drill, 31 bulldozers, 16 frontend loaders, eight coal drills, two power brooms, and an undetermined number of haulage trucks.

As in the previous year, Mercer County produced about one-half of the State's lignite production.

Basin Electric Power Cooperative of Bismarck announced that in 1973 it will spend more than $60.5 million for construction. The biggest single item will be for continuation of work on the second unit, which will be 450 megawatts, at the Leland Olds powerplant at Stanton. Related work includes construction of 526 miles of extra high-voltage transmission lines. Two 345 kilovolt lines will leave the plant, one extending 293 miles to Fort Thompson, S. Dak., and the other to Watertown, S. Dak. Construction of the second generating unit, to be commissioned by 1975, will bring total generating capacity to 650,000 megawatts. Total cost of the second unit is $93 million.[3]

Natural Gas.—Marketed natural gas totaled 32,472 million cubic feet, 4.1% less than that of 1971. The average value at 16.8 cents per thousand standard cubic feet was almost unchanged from 1971. No new gas discoveries were made in 1972. Again most of the gas came from three natural gas processing plants, except some dry gas coming from 21 producing wells, seven less than in 1971. The Signal Companies, Inc. was the principal purchaser of natural gas.

Estimated total proved reserves of natural gas, totaling 503.7 billion cubic feet at the start of the year, decreased to 441.6 billion cubic feet at yearend, partly because of revisions.[4]

Natural Gas Liquids.—The production of natural gas liquids, comprising liquid petroleum and natural gasoline cycle products declined 10%; its value declined 3.5%. Three natural gas processing plants—Lignite Gas Plant, at Lignite; North Tioga Gas Plant, at Gregor; and Signal Companies, Inc. at Tioga—continued processing casing-head gas. Sulfur was recovered at two of these operations, namely the Signal Companies, Inc. plant and the Lignite Gasoline plant. Estimated total proved reserves of natural gas liquids at the start of 1972 was 47.1 million barrels, compared with 45.4 million barrels at yearend.[5]

Petroleum.—Crude oil production declined for the sixth consecutive year, because development failed to offset the normal depletion of reservoirs. Output was down 4.8% below the 1971 level, while its value decreased by 4.5%.

During 1972, 50 drilling permits were issued, 79 fewer than in 1971; 124 producing wells were abandoned; and only 23 new producing wells were completed. Production continued to drop during the year as the older fields continued their natural

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[3] Bismark Tribune, Feb. 20, 1973.

[4] American Gas Association, American Petroleum Institute, and The Canadian Petroleum Association. Reserves of Crude Oil, Natural Gas Liquids, and Natural Gas in the U.S. and Canada, v. 27, May 1973, p. 114, table 1.

[5] Table 4 of work cited in footnote 4.

Table 5.—North Dakota: Lignite strip production, by county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines	Production (thousand short tons)	Value (thousands)
Adams	2	19	W
Bowman	1	166	W
Burke	2	487	W
Grant	1	3	W
McLean	1	16	W
Mercer	3	3,148	W
Oliver	2	2,278	W
Stark	1	117	W
Ward	1	393	W
Williams	1	5	W
Total	15	6,632	$13,416

W Withheld to avoid disclosing individual company confidential data.

decline. The new fields discovered in 1972 were not sufficiently developed to offset the decline. Lack of energy-supplementation projects to add additional reserves resulted in a reduction of total remaining reserves.

The American Petroleum Institute reported,[6] that 99 wells, with a total depth of 654,230 feet were drilled in 1972. Of these, 23 were oil wells and 76 were dry wells. There were no gas wells drilled. Exploratory well drilling, 86,305 feet less than in 1971, totaled 486,006 feet for 65 wells. The drilling was distributed between seven oil wells and 58 dry wells, a 12.1% success ratio. Development well drilling totaled 34 wells, distributed among 16 oil wells and 18 dry wells. The total number of exploratory and development wells was 63 less than the 162 drilled in 1971; the total footage drilled was 318,247 feet less than the 972,477 feet drilled in 1971.

According to the Petroleum Information Corp.[7] successful deep drilling in western North Dakota was the highlight of exploratory activity in the Williston Basin in 1972. Seven of the State's new field discoveries were in the "central fairway" of the basin, west and southwest of the Nesson anticline. Among them are some of the Rocky Mountain Region's top discoveries of the year. This successful work may reverse the general downward trend in activity that has been in evidence during the past decade. Drilling in North Dakota during 1972 dropped to its lowest level in 20 years.

Wildcat drilling in North Dakota during 1972 departed from the previous decade's pattern in which the areas between Mississippian pools in the north central part of the State and the Nesson anticline captured the bulk of the exploratory effort. In recent years, however, the relatively untested areas in the southwest part of the State have been getting a larger share of the attention. The Mississippian provided the reservoir at five of the successful wildcats. Red River produced at the others and one of these Ordovician discoveries was dually completed from Winnipegosis (Devonian) as well.

True Oil's 22–27 Burlington Northern Inc., SE NW 27-148N-101W, McKenzie County, tapped a reservoir of great potential, with 2,700 feet of effective pay indicated in Mississippian. Oil shows were found almost continuously in samples from 6,800 to 9,200 feet, and from 9,400 to 9,800 feet. A drillstem test at 6,803 to 6,398 feet flowed 43.5 gravity oil in 35 minutes. The well bottomed in the Ordovician level at 13,720 feet and was cased to 10,588 feet. Although three porosity zones were perforated between 8,874 and 9,498 feet, and are capable of production, only one zone (8,874 to 8,890 feet) was open when the well was completed for 500 barrels of oil per day through a 20/64-inch choke. None of the pay between 6,800 and 9,000 feet has been tested since the pipe was set. The discovery found a unique structural anomoly associated with a complex fault system, not normally found in an area characterized by gentle dipping structures and subtle stratigraphic changes. Many normal faults were found in the Mississippian section. The pre-Mississippian section had several reverse faults.

True's northwest offset, 11–27 Burlington Northern, NW NW 27-148N-101W, confirmed the discovery and was completed flowing 430 barrels of oil per day on a one-quarter-inch choke from the Mission Canyon at 9,060 to 9,082, 9,124 to 9,142, 9,168 to 9,169, and 9,368 to 9,379 feet. It bottomed in the Lodgepole formation at 10,218 feet. This well, an 80-acre northwest offset to the discovery, ran 2,400 feet low, structurally, at the top of Mission Canyon compared with the field opener. It also found oil in the Kibbey zone of the Mississippian formations. There is no production from Kibbey in North Dakota. True was drilling a northeast offset at year's end. Working interest owners in the wells are True, with 81.25%; Amoco Production Co., with 6.25%; Tiger Oil, with 6.25%; Newmont Oil, with 4.68%; and Franklin, Aston & Fair, with 1.56%. This well was drilled on lands farmed out by Rainbow Resources, but Rainbow sold its interest in the immediate area for more than $10 million.

Seventeen miles south of Red Wing Creek field, Belco Petroleum Corp.'s 1–28 Roughrider, SW SW 28-145N-101W, McKenzie County, found oil in the Madison formation. This discovery is 3 miles southwest of the Rough Rider, Inc., Madison pool established 13 years ago. Its delineation was expanded to include the

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[6] Source: American Petroleum Institute.

[7] 1972 Resume, Petroleum Information Corp., Dallas, Tex., 1973, pp. RM–17–RM–18.

Belco discovery. The well flowed 560 barrels of oil per day through a 12/64-inch choke. Only 4 feet of the Madison, between 9,253 and 9,257 feet, was opened.

Three Red River discoveries were posted in the southwest corner of the State. Depco Inc. and Hanover Planning completed a Bowman County prospect, 33–20 Dronen, NW SE 20-130N-103W, flowing 258 barrels of oil per day on a 16/64-inch choke. Red River A, B, and C zones are perforated selectively between 9,381 and 9,536 feet. This producer is 2 miles southeast of Medicine Pole Hills field.

Depco and Hanover scored again in Bowman County, finding another Red River field nine miles southeast of Medicine Pole Hills. Their 33–26 Greni, NW per day through a 24/64-inch choke from three Red River porosity zones between SE 26-129N-103W, flowed 624 barrels of oil 8,926 and 9,146 feet. Both discoveries evaluated seismic prospects. Two and one-half miles west of Bowman County's Horse Creek field, Eason Oil Co. completed a Red River producer at 1–13 Olson, SW SW 13-129N-105W. It pumped 156 barrels of oil and 193 barrels of water per day.

Farmers Union Central Exchange, W. R. Grace & Co. and Inexco Oil Company completed a confirmation well in Coyote Creek field flowing 313 barrels of oil and 31 barrels of water per day. It produces from Red River B and D zones. Lamar Hunt finaled the Rider field Nesson (Madison) discovery well in early 1972 pumping 343 barrels of oil and 75 barrels of water per day. This Golden Valley County well, 1 Osterhout, N SW 24-140N-103W, produces from 9,025 to 9,028 feet, and is the first Nesson zone success in this part of the State.

Lone Star Producing Co. recorded a Madison discovery 2 miles north of the Heath area in the Rocky Ridge field. Its 1 Schwartz, NE NW 2-137N-100W, Billings County, pumped 218 barrels of oil and 66 barrels of water per day from the Fryburg zone of the Madison. Except for the Mississippian pools along the south-east edge of the Cedar Creek anticline, the Lone Star well established the southernmost Madison production in the Williston Basin. The Madison producer was combined with Rocky Ridge field and designated a new pay discovery by the State geological survey. In the same area, Petroleum Inc. and others completed a 1¼ mile southeast stepout from Rocky Ridge, in 12-136N-100W, Slope County. It pumped 70 barrels of oil per day from the Heath formation at 7,889 to 7,895 feet.

Meanwhile, the Nesson anticline, site of the first commercial wells in the Williston Basin, continued to offer opportunities. Work in 1972 demonstrated that there are

Table 6.—North Dakota: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Benson	--	--	--	--	--	1	1	2,775
Billings	--	--	--	1	--	3	4	38,451
Bottineau	5	--	6	--	--	3	14	59,546
Bowman	1	--	1	3	--	1	6	57,613
Burke	2	--	1	1	--	--	4	31,660
Divide	--	--	--	--	--	3	3	14,811
Dunn	--	--	--	--	--	6	6	47,959
Golden Valley	--	--	--	1	--	1	2	18,225
Grand Forks	--	--	--	--	--	1	1	1,745
McHenry	--	--	--	--	--	2	2	9,756
McKenzie	1	--	--	--	--	1	2	18,475
Morton	--	--	--	--	--	2	2	10,086
Mountrail	--	--	--	--	--	1	1	11,785
Pierce	--	--	--	--	--	3	3	9,758
Ramsey	--	--	--	--	--	1	1	2,016
Renville	6	--	4	--	--	5	15	77,014
Slope	--	--	--	1	--	2	3	24,501
Stark	--	--	3	--	--	7	10	88,562
Ward	1	--	3	--	--	13	17	108,663
Williams	--	--	--	--	--	2	2	20,829
Total	16	--	18	7	--	58	99	654,230

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

still areas along this structure to be evaluated. A deeper pay test in the Stoneview field, on the north side of the anticline, found oil shows in seven zones in the lower Mississippian and pre-Mississippian rocks. The North American Royalties, Inc., H. L. Hunt and L. W. Hill, 1 Holte-Bank of North Dakota, NE NW 31-161 N-94W, H. L. Hunt and L. W. Hill, 1 Holte-Bank of North Dakota, NE NW 31-161N-94W, Burke County, was completed from Winnipegosis (Devonian) 10,714 to 10,722 feet, flowing 160 barrels of oil per day. It also flowed 3,000,000 cubic feet of gas and 72 barrels of condensate per day from Red River 12,090 to 12,104 feet but, owing to the lack of an outlet for the gas, the lower zone was shutin. The well also recovered oil from Bakken and Nisku, two separate zones in Duperow and Silurian. The deep test is the first well at Stoneview to penetrate horizons below Nesson. A Midale discovery in Bottineau County was completed by Gemini Corp. and others in NW SE 15-162N-79W, 2½-miles southeast of the Landa field. It was the only wildcat success among the 25 north central North Dakota wildcats drilled this year.

At yearend, there were 1,946 wells capable of producing oil, of which 749 were stripper wells. It is estimated that about 51.8% of the reserves could be recovered from 25 of the 134 producing pools by energy supplementation. On January 1, 1973, primary plus secondary reserves considered to be recoverable with present equipment and techniques totaled 667.8 million stock tank barrels. At yearend, reserves were 664.6 barrels, of which 305.1 million barrels were classed as primary and 315.2 million barrels were classed as secondary.[8]

NONMETALS

Clays.—Compared with 1971, the total production of clays was 11% less, and its total value decreased by 9.3%.

Gem Stones.—Total value of gem stones gathered in the State was about the same as that of 1971, according to estimates. Stones usually produced in the State included agate, chalcedony, jasper, and petrified wood.

Lime.—American Crystal Sugar Co. produced lime in Pembina County for sugar refining. Output decreased 10% and was 22% below the 1969 record high. Total consumption of lime in North Dakota was 36,810 tons.

Salt.—North Dakota's only salt producer, Dakota Salt & Chemical Co., which produces evaporated salt, produced 68% more by weight and 97% more in value than in 1971.

Sand and Gravel.—There were 161 active sand and gravel operations in 1972, one more than in 1971. These operations included 117 commercial, two Federal, 36 county, and six municipal plants. The volume of sand and gravel production decreased by 18.5%, although its value decreased by only 7.3%.

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[8] Folsom, Clarence B. Jr. North Dakota Crude Oil Inventory as of January 1, 1973. N. Dak. Geol. Survey, Misc. Series No. 51, 1972, 11 pp.

Table 7.—North Dakota: Crude oil production, by county

(Thousand 42-gallon barrels and thousand dollars)

County	Quantity		Principal fields in 1972 in order of production
	1971	1972	
Billings	1,675	1,858	Fryburg, Medora, Rocky Ridge.
Bottineau	2,844	2,938	Newburgh, South Westhope, Wiley.
Bowman	933	981	Cedar Creek, Medicine Pole Hills.
Burke	1,800	1,750	Rival, North Tioga, Northeast Foothills, Black Slough.
Divide	255	209	North Tioga, Stoneview.
Dunn	15	12	Lost Bridge.
Golden Valley	64	90	Square Butte.
McHenry	17	20	Pratt.
McKenzie	4,287	3,978	Antelope, Charlson, Blue Buttes, Hawkeye, Clear Creek.
Mountrail	503	447	Tioga.
Renville	1,665	1,765	Sherwood, Glenburn.
Slope	129	120	Eleven Bar.
Stark	1,721	1,242	Dickinson, West Dickinson, Zenith.
Ward	662	459	South Lone Tree, Lone Tree.
Williams	5,083	4,755	Beavers Lodge, Tioga, Grenora, Capa.
Total	21,653	20,624	
Value	70,805	67,647	

Source: Quantity, North Dakota Geological Survey; Value, U.S. Bureau of Mines.

Stone.—Shipments of stone in 1972 decreased 94.1% in quantity and 95.3% in value. All stone was crushed and broken stone, and included limestone and other stone. The unit value was $2.00 per ton for limestone, $1.50 per ton for other stone, and averaged $1.73 per ton for all stone. Almost all of the stone shipped was by truck.

Sulfur.—Natural gas processing plants at Lignite and Tioga recovered elemental sulfur as a byproduct. The output of sulfur increased from 1971 by 12% and the value increased by 6.5%.

Vermiculite.—In 1972, vermiculite continued to be shipped into the State and was exfoliated and sold by the Robinson Insulation Co. at Minot. Some of its uses, in decreasing order, were pipe covering insulation, loose fill insulation, concrete and plaster aggregates, poultry litter, and soil conditioning.

Volcanic Ash (Pumice).—Production of volcanic ash was started in 1972. Average value was 90¢ per ton. The crude volcanic ash was used for road construction.

Table 8.—North Dakota: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	555	769	470	757
Fill	194	160	W	W
Paving	457	382	82	85
Other uses	13	16	305	200
Total[1]	1,218	1,327	856	1,043
Gravel:				
Building	1,159	1,363	665	1,204
Fill	154	149	226	182
Paving	3,266	2,244	2,864	2,107
Railroad ballast	--	--	W	W
Miscellaneous	47	39	31	55
Other uses	209	130	66	87
Total[1]	4,835	3,924	3,851	3,635
Government-and-contractor operations:				
Sand:				
Fill	45	8	79	31
Paving	126	145	84	8
Total[1]	171	152	163	39
Gravel:				
Building	286	39	135	110
Fill	99	20	90	11
Paving	1,579	748	1,521	909
Other uses	8	1	65	9
Total[1]	1,972	806	1,811	1,039
Total sand and gravel[1]	8,196	6,210	6,681	5,757

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Data may not add to totals shown because of independent rounding.

Table 9.—Principal producers

Commodity and company	Address	Type of activity	County
Clays:			
Baukol-Noonan, Inc	Noonan, N. Dak. 58765	Open pit mine and plant	Morton.
Hebron Brick Co	Hebron, N. Dak. 58638	Open pit mine	Do.
Coal:			
Baukol-Noonan, Inc	Noonan, N. Dak. 58765	Strip mine; crushing plant, thermal drying.	Burke.
Consolidation Coal Co., Western Division.	Box 200 Stanton, N. Dak. 58571	Strip mine	Oliver.
		Crushing plant	Mercer.
		Strip mine and crushing plant.	Ward.
Knife River Coal Mining Co.	Bismarck, N. Dak. 58501	do	Bowman, Mercer.
North American Coal Corp., Lignite Division.	12800 Shaker Blvd. Cleveland, Ohio 44120	do	Mercer.
Lime: American Crystal Sugar Co.	Box 419 Denver, Colo. 80201	Shaft kiln at beet sugar refinery.	Pembina.
Natural gas and petroleum:			
Amerada Hess Corp	Box 2040 Tulsa, Okla. 74102	Crude oil wells: Fryburg field.	Billings.
		Crude oil wells: Lost Bridge field.	Dunn.
		Crude oil wells: Antelope, Blue Buttes, and Charlson fields.	McKenzie.
		Crude oil wells: Beaver Lodge field.	Williams.
American Oil Co	910 South Michigan Ave. Chicago, Ill. 60680	Refinery	Morton.
Chevron Oil Co., Western Division	1700 Broadway Denver, Colo. 80202	Crude oil wells: Glenburn field.	Renville.
Chandler & Associates, Inc	1401 Denver Club Bldg. Denver, Colo. 80202	Crude oil wells: Sherwood field.	Bottineau.
Hunt Oil Co. (Hunt Industries).	1401 Elm Dallas, Tex. 75202	Crude oil wells: North Tioga field and gas processing plant.	Burke.
Marathon Oil Co	539 South Main St. Findley, Ohio 45840	Crude oil wells: Glenburn field.	Renville.
Amoco Production Co	Box 591 Tulsa, Okla. 74102	Crude oil wells: Black Slough and Rival fields.	Burke.
Petroleum, Inc	800 West Douglas Wichita, Kans. 67202	Crude oil wells: Sherwood field.	Bottineau.
Shell Oil Co	50 West 50th St. New York, N.Y. 10020	Crude oil wells: Cedar Creek field.	Bowman.
The Signal Companies, Inc	1010 Wilshire Blvd. Los Angeles, Calif. 90017	Crude oil wells: Tioga field.	Mountrail.
		Crude oil wells: Beaver Lodge field and gas processing plant.	Williams.
Tenneco Oil Co	Box 2511 Houston, Tex. 77051	Crude oil wells: Glenburn field.	Renville.
Texaco Inc	Box 52332 Houston, Tex. 77052	Crude oil wells: Blue Buttes and Charlson fields.	McKenzie.
		Gas processing plant	Burke.
Union Oil Co. of California	Box 7600 Los Angeles, Calif. 90017	Crude oil wells: Sherwood field.	Renville.
Westland Oil Co	Box 1549 Minot, N. Dak. 58701	Refinery	Williams.
Salt: Dakota Salt & Chemical Co.	P.O. Box 7063 St. Louis, Mo. 63177	Well and plant	Do.
Sand and gravel:			
A. Campbell, Inc	New Rockford, N. Dak. 58356	2 plants	Various.
Minot Sand and Gravel Co	Box 116 Minot, N. Dak. 58702	Pit and plant	Ward.
Schriock Constr. Inc	Rural Route 3, Radio City Minot, N. Dak. 58701	1 plant	Various.
Tennefos Constr. Co., Inc	2504 Fifth Ave., South Fargo, N. Dak. 58101	2 plants	Do.
Stone:			
A. Campbell, Inc	New Rockford, N. Dak. 58356	Quarry	Golden Valley.
Hansted Sand & Gravel Co	Rt. 1 Jamestown, N. Dak. 58401	do	Stutsman.
Industrial Builders Inc	Box 406 Fargo, N. Dak. 58102	2 quarries	Dickey, Sargent.

The Mineral Industry of Ohio

By Joseph A. Sutton[1]

Ohio's 1972 record-setting mineral production, valued at $724.7 million, was dominated by increased values for cement, coal, lime, natural gas, petroleum, and sand and gravel. These commodities accounted for 74% of the $72.6 million increase over the 1971 total. Mineral production was reported in all of the State's 88 counties except Fulton. Harrison and Muskingum Counties with mineral output values of $50 million and $41 million respectively, were the State's leading mineral-producing areas. The ever-growing National and State markets for such energy and construction materials as oil, natural gas, clay, cement, stone, and sand and gravel stimulated gains in Ohio mineral production. Nationally, the State continued to be an important producer of bituminous coal, stone, lime, salt, and clay.

Employment and Injuries.—Final 1971 statistics and preliminary data for 1972 on employment and injuries in the mineral industry, excluding the petroleum industry, are given in table 4.

Legislation and Government Programs.—A gas well owner's production statement law was passed by the Ohio Senate and became effective July 14, 1972. The new law, which amended substitute Senate Bill 387, requires a gas well owner, upon request of the royalty interest holder of a well, to furnish to the royalty holder a statement of the volume of gas produced by the well. The purpose of the law was to give the owner of land upon which a gas well is located a means of ascertaining the amount of gas that a producer obtained from his land, in order to determine whether the producer paid royalties on all gas produced.

Amended House Bill 94 extended the date for prohibition of oil and gas drilling from or under the bed of Lake Erie to July 1, 1974.

The passage of amended substitute Senate Bill 397 created a state Environmental Protection Agency (EPA); assigned the EPA Director powers and duties for administering the laws governing air pollution, solid waste disposal, public water supply, disposal and treatment of sewage and industrial planning; provided for citizen participation in EPA proceedings; created an Environmental Board of Review to hear appeals from actions of the Director; and created a Power Siting Commission to approve the location, and emission and discharge requirements of powerplants and electric and gas transmission lines.

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[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Ohio[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland ____________thousand short tons__	2,897	$54,338	2,968	$57,953
Masonry ____________do____	142	3,811	161	4,684
Clays ____________do____	3,973	11,380	4,125	11,273
Coal (bituminous) ____________do____	51,431	269,601	50,967	303,819
Gem stones ____________	NA	8	NA	8
Lime ____________thousand short tons__	4,007	65,258	4,413	75,569
Natural gas ____________million cubic feet__	79,903	27,007	89,995	35,271
Peat ____________thousand short tons__	6	84	4	67
Petroleum (crude) _thousand 42-gallon barrels__	8,286	29,801	9,358	35,179
Salt ____________thousand short tons__	5,709	46,651	6,147	47,710
Sand and gravel ____________do____	40,797	54,044	43,506	59,932
Stone ____________do____	46,891	88,372	48,498	90,821
Value of items that cannot be disclosed:				
Abrasive stone and gypsum ____________	XX	1,796	XX	2,462
Total ____________	XX	652,151	XX	724,748
Total 1967 constant dollars ____________	XX	554,524	XX	[p] 602,918

[p] Preliminary. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

Table 2.—Value of mineral production in Ohio, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	W	$1,673	Stone.
Allen	$1,627	W	Stone, sand and gravel.
Ashland	W	W	Sand and gravel, clays.
Ashtabula	3,172	W	Lime, sand and gravel.
Athens	W	1,278	Sand and gravel, stone, coal.
Auglaize	W	W	Stone, sand and gravel, clays.
Belmont	72,142	W	Coal, stone.
Brown	W	W	Sand and gravel, stone.
Butler	3,467	3,957	Sand and gravel.
Carroll	2,215	2,253	Coal, clays, sand and gravel, stone.
Champaign	W	W	Sand and gravel, peat.
Clark	W	W	Sand and gravel, stone.
Clermont	W	W	Stone, sand and gravel.
Clinton	W	W	Do.
Columbiana	6,838	W	Coal, clays, sand and gravel.
Coshocton	14,119	18,945	Coal, sand and gravel, stone, clays.
Crawford	W	W	Stone, sand and gravel.
Cuyahoga	13,381	14,585	Salt, lime, clays, sand and gravel.
Darke	W	W	Sand and gravel, clays.
Defiance	W	W	Sand and gravel.
Delaware	W	W	Stone, lime, clays, sand and gravel.
Erie	W	W	Lime, stone, sand and gravel.
Fairfield	495	W	Sand and gravel.
Fayette	W	W	Stone.
Franklin	10,198	12,688	Sand and gravel, stone, clays, peat.
Gallia	2,068	W	Stone, coal, sand and gravel.
Geauga	2,933	W	Stone, sand and gravel.
Greene	21,473	24,704	Cement, stone, sand and gravel, clays.
Guernsey	W	6,197	Coal, stone.
Hamilton	W	6,213	Sand and gravel, stone.
Hancock	W	W	Stone, lime.
Hardin	W	W	Stone.
Harrison	51,891	50,030	Coal, stone, clays.
Henry	W	W	Sand and gravel, clays.
Highland	W	1,071	Stone.
Hocking	W	W	Coal, clays, sand and gravel.
Holmes	4,587	4,087	Coal, clays, stone, sand and gravel.
Huron	249	W	Sand and gravel, stone.
Jackson	7,527	W	Coal, clays, stone.
Jefferson	27,986	33,986	Coal, clays.
Knox	W	W	Sand and gravel, stone.
Lake	30,104	29,414	Lime, salt, sand and gravel, stone.
Lawrence	7,051	6,421	Cement, clays, coal, sand and gravel, stone.
Licking	1,287	1,218	Sand and gravel, clays.
Logan	W	877	Stone, sand and gravel.
Lorain	W	7,781	Lime, stone, sand and gravel, grindstone.
Lucas	W	W	Cement, stone, sand and gravel, clays.
Madison	775	W	Stone, sand and gravel.
Mahoning	8,284	8,957	Stone, coal, clays, sand and gravel, peat.
Marion	W	W	Stone, clays, sand and gravel.
Medina	W	W	Sand and gravel, clays.
Meigs	1,604	2,559	Sand and gravel, coal, salt.
Mercer	W	W	Stone.
Miami	W	W	Stone, sand and gravel.
Monroe	W	W	Coal, stone, sand and gravel.
Montgomery	W	W	Sand and gravel, stone.
Morgan	3,642	W	Coal, sand and gravel, stone.
Morrow	73	100	Sand and gravel.
Muskingum	44,885	41,451	Coal, cement, stone, sand and gravel, clays.
Noble	W	W	Coal, stone.
Ottawa	W	W	Stone, lime, gypsum.
Paulding	12,174	13,357	Cement, stone, clays.
Perry	W	W	Coal, stone, clays.
Pickaway	W	W	Sand and gravel, stone.
Pike	1,103	1,102	Stone, sand and gravel.
Portage	4,127	4,139	Sand and gravel.
Preble	W	W	Do.
Putnam	W	W	Stone, sand and gravel, clays.
Richland	W	W	Sand and gravel, clays, peat.
Ross	W	W	Sand and gravel, stone.
Sandusky	25,119	W	Lime, stone, sand and gravel.
Scioto	1,962	1,317	Stone, clays, sand and gravel.
Seneca	W	W	Lime, stone, clays.
Shelby	W	W	Sand and gravel, stone.
Stark	14,557	12,390	Cement, sand and gravel, coal, stone, clays, peat.

See footnotes at end of table.

Table 2.—Value of mineral production in Ohio, by county[1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Summit	$27,362	$30,011	Salt, lime, stone, cement, sand and gravel.
Trumbull	W	W	Sand and gravel.
Tuscarawas	15,398	13,698	Coal, clays, sand and gravel, stone.
Union	W	W	Stone, sand and gravel.
Van Wert	W	1,149	Stone, clays.
Vinton	W	W	Coal, clays, stone.
Warren	2,054	W	Sand and gravel, stone.
Washington	W	W	Coal, sand and gravel, stone.
Wayne	13,154	14,345	Salt, sand and gravel, stone, coal, clays.
Williams	W	W	Sand and gravel, peat.
Wood	2,074	W	Stone.
Wyandot	W	10,485	Stone, lime, sand and gravel, clays, peat.
Undistributed[2]	189,500	342,462	
Total[3]	652,151	724,748	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Fulton County is not listed because no production was reported. Natural gas and petroleum values are not listed by counties as data are not available; included with "Undistributed."

[2] Includes some sand and gravel (1972) and stone (1972) that cannot be assigned to specific counties, natural gas, petroleum, gem stones, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Ohio business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force ......thousands..	4,528.6	4,584.5	+1.2
Unemployment ......do....	236.6	199.0	−15.9
Employment (nonagricultural) ......do....	3,839.5	3,934.0	+2.5
Manufacturing ......do....	1,331.5	1,343.6	+0.9
Transportation and public utilities ......do....	223.9	223.3	−.3
Wholesale and retail trade ......do....	782.9	813.3	+3.9
Finance, insurance, and real estate ......do....	162.4	167.2	+3.0
Services ......do....	591.9	615.7	+4.0
Government ......do....	577.2	590.3	+2.3
Contract construction ......do....	148.6	157.0	+5.7
Mining ......do....	21.1	23.1	+9.5
Personal income:			
Total ......millions..	$44,833	$48,656	+8.5
Per capita	$4,175	$4,512	+8.1
Construction activity:			
Number of housing units authorized	86,976	84,960	−2.3
Value of private nonresidential construction millions..	$620.2	$659.5	+6.3
Cement shipments to and within the State thousand short tons..	3,580	3,570	−.3
Mineral production value ......millions..	$652.2	$724.7	+11.1

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	9,215	236	2,175	17,496	4	650	37.38	NA
Nonmetal	1,962	261	511	4,116	1	109	26.72	2,310
Sand and gravel	2,039	228	466	4,019	3	64	16.67	7,265
Stone	5,066	274	1,390	11,262	3	181	16.34	2,170
Total	18,282	248	4,542	36,893	11	1,004	27.51	NA
1972:[1]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Nonmetal	1,210	263	318	2,547	--	69	27.09	512
Sand and gravel	1,856	235	436	3,696	--	76	20.56	888
Stone	4,395	282	1,241	10,087	1	186	18.54	1,316
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Stones.—Reversing a downward trend of recent years, production and value of abrasive stone (grindstones) were greater than those of 1971. Output was from one operation in Lorain County as a byproduct of sandstone quarrying at Amherst.

Cement.—Portland cement was produced at eight plants of which five also produced masonry cement. Shipments of portland and masonry cement were 2.4% and 13.3%, respectively, above those of the previous year. Average value per ton of portland cement increased from $18.76 in 1971 to $19.53; average value of masonry cement increased from $26.84 per ton to $29.09. Consumption of cement in the State totaled 3.3 million tons of portland cement and 0.2 million tons of masonry cement. Ohio producers supplied 88% of the portland cement and 70% of the masonry cement consumed. Raw materials used in making portland cement included limestone and cement rock, clay and shale, sand, gypsum, and iron-bearing materials. Yearend stocks of portland were 76,000 tons above those of the previous year, but stocks of masonry cement were 932 tons less.

Portland cement shipments by type of customer were as follows: Ready-mix concrete, 1.8 million tons; concrete product manufactures, 0.5 million tons; building material, 0.2 million tons; and contractors and other users, 0.4 million tons. Approximately 2.3 million tons was shipped by truck and 0.2 million tons by rail. Most of the cement was delivered in bulk form; only 6% of the portland cement was shipped in containers.

Southwestern Portland Cement Co., subsidiary of Southdown, Inc., started construction of new facilities at Fairborn, to replace the 47-year-old plant. The $17 million project includes a 15-foot-diameter by 220-foot-long kiln equipped with a suspension preheater, the combination having an annual capacity of 620,000 tons. When completed in 1974, the company expects a 20% increase over present production output and a 40% decrease in fuel consumption.

The Jonathan limestone mine operated by Columbia Cement Corp., subsidiary of PPG Industries Inc. was awarded the Certificate of Achievement in Safety in the Underground Nonmetal Group of National Safety Competition. The mine operated 105,519 man-hours without any lost-time injuries.

Clays.—Production of clay (common clay-shale, fire clay, and kaolin) was 4% above that of 1971. Clay used in refactories totaled 803,493 tons compared with 658,229 tons in 1971. Of the total clay produced in the State, 80% was common clay and shale used chiefly in making heavy clay products, 19% was fire clay used chiefly for refractory products, and the remainder was kaolin used mostly for glazes, glass, and enamels. Clays used in manufacturing heavy clay products (mainly brick) was 8% above that

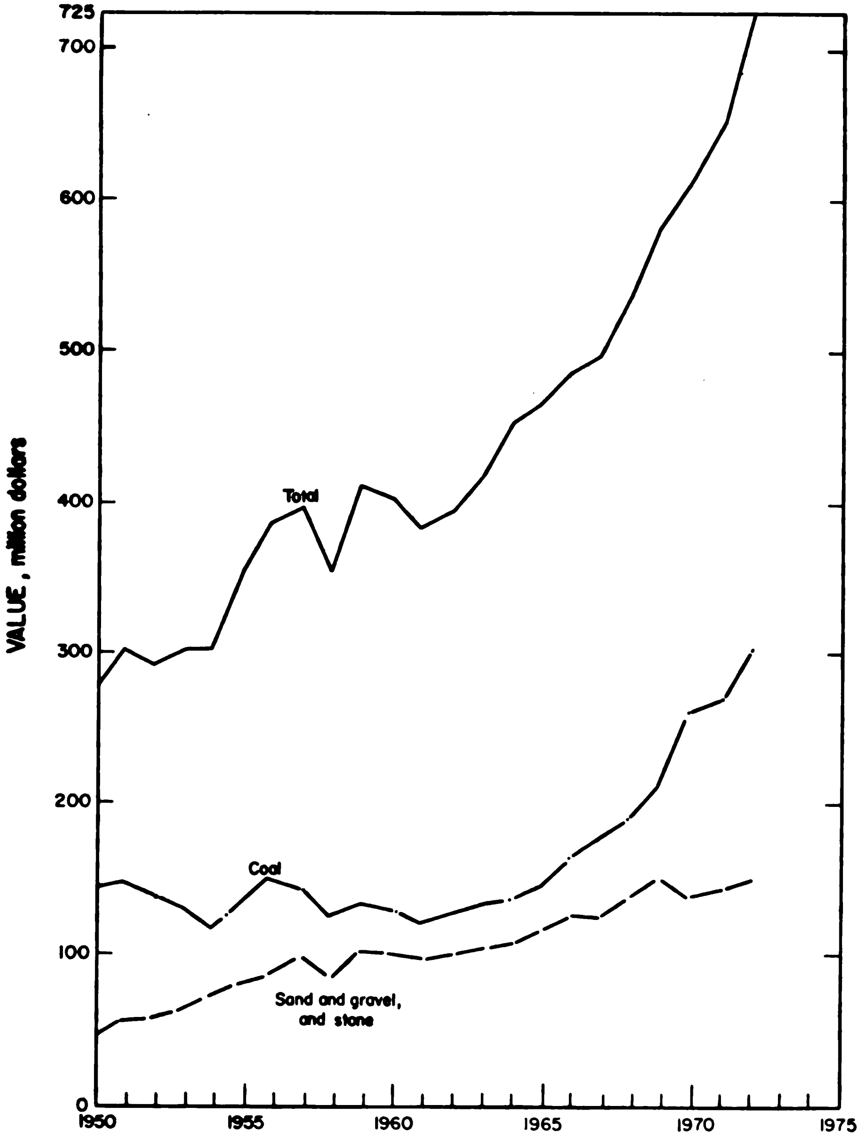

Figure 1.—Value of coal, sand and gravel, and stone, and total value of mineral production in Ohio.

of the previous year. Clay output for refractories was 22% above the 650,257 tons produced in 1971, and most of the clay was used in firebrick, block, and shapes. Clay used for pottery and other uses totaled 28,371 tons. Of the 36 counties producing common clay and shale, Tuscarawas, Cuyahoga, Stark, Greene, and Mahoning were the leading areas, accounting for 64% of the common clay and shale tonnage. Among the 10 counties producing fire clay, Columbiana, Jackson, and Tuscarawas led in production and accounted for 59% of the fire clay tonnage.

Table 5.—Ohio: Portland cement salient statistics

	1971	1972
Number of active plants	8	8
Production short tons	2,813,618	2,885,182
Shipments from mills:		
Quantity short tons	2,897,308	2,968,081
Value	$54,838,328	$57,958,227
Stocks at mills, Dec. 31 short tons	279,628	355,604

The average value for clays sold in 1972 was 13 cents per ton below that of 1971. Average unit value per ton of various types of clays was: Common clay and shale, $1.83; fire clay, $6.38; kaolin (airfloat), $10; and kaolin (unprocessed), $4.55.

Gem Stones.—Gem and mineral specimen collectors, mostly members of mineral and lapidary clubs, were active at mines and quarries throughout the State. Value of materials collected remained the same as that of 1971. Specimens collected included calcite, celestite, flint, and jasper. Flint, the State's official gem stone, was recovered chiefly at Flint Ridge in southeastern Licking County and the adjacent area of Muskingum County.

Graphite (Synthetic).—The Ohio Carbon Co. at Cleveland produced synthetic graphite from petroleum coke. Output was shaped for use in electrical motor brushes, hermetic sealings, and pitch coke.

Gypsum.—United States Gypsum Co. and Celotex Corp. mined crude gypsum in Ottawa County. Output decreased 1%. Celotex, U.S. Gypsum, and National Gypsum Co., calcined gypsum in Lorain and Ottawa Counties. Output increased 25%.

Lime.—Eighteen companies produced lime at 19 plants in 12 counties. Leading counties were Sandusky, Lake, and Summit. Leading producers were PPG Industries, Inc., Diamond Shamrock Chemical Co., and Martin-Marietta Chemicals. Output increased 10% to a record 4,413,000 tons, 6% above the 1969 record. Among the States, Ohio ranked first in lime production. The lime was used for steel furnaces, alkalies, refractories, glass, and other uses. The lime was consumed in Ohio, Pennsylvania, West Virginia, Michigan, and many other destinations. Total consumption of lime in Ohio was 3,655,000 tons.

Perlite (Expanded).—Crude perlite shipped from Western States was processed and expanded at four plants located in Cuyahoga, Hamilton, Lorain, and Ottawa Counties. The quantity of expanded perlite sold or used in 1972 was increased 66%. Most of the expanded material was processed for plaster aggregate and low-temperature insulation material.

Salt.—Ohio continued as a leading salt producing state, ranking third in national output. Salt sold or used was 438,000 tons above that of the previous year and its value increased about $1 million to $47.7 million. Salt in the forms of brine, evaporated brine and rock, sold or used by producers totaled 6.1 million tons, 0.4 million tons more than in 1971. Rock salt recovered from underground mines in Cuyahoga and Lake Counties was sold mainly for highway ice control and chemical applications. Evaporated salt produced in Cuyahoga, Meigs, Summit, and Wayne Counties was sold for a wide variety of uses; some was marketed as pressed block. Evaporated salt producers used both the vacuum and the open-pan processes for recovering the salt. Lake County with two operations continued to rank first in output.

Sand and Gravel.—Sand and gravel production increased 7% above that of 1971. Value was 11% higher and totaled $59.9 million. Output was 2.7 million tons more than that of 1971. The increase was attributed mainly to higher demand for building and paving materials. Commercial sand and gravel used in building and highway construction totaled 38.4 million tons, almost 3 million tons more than in 1971. Production and value of industrial sand was equal to 392,000 tons valued at approximately $1.3 million. Most of the industrial sand was marketed for molding, furnace construction, and repair.

Sand and gravel was produced in 68 counties. Franklin, Hamilton, Butler, Montgomery, and Portage Counties, each with output in excess of 2 million tons, were the leading areas. In addition, six other counties had production exceeding 1 million tons. Commercial producers processed 91% of the total tonnage by washing, screening, sizing, or crushing. Over 41.7 million tons of sand and gravel was shipped to consumers by truck and the remainder by rail or water. The number of commercial operations totaled 338.

Table 6.—Ohio: Lime sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Basic oxygen furnaces	1,307	20,096	1,647	26,857
Refractory dolomite	553	10,311	645	12,291
Glass	340	4,983	362	5,899
Construction	181	4,725	175	4,565
Electric furnaces	81	1,380	104	1,694
Open-hearth furnaces	69	956	100	1,632
Water purification	95	1,417	77	1,261
Miscellaneous chemicals	44	750	24	385
Sewage treatment	W	W	14	233
Agriculture	8	204	11	294
Other uses [1]	1,329	20,436	1,254	20,458
Total	4,007	65,258	4,413	75,569

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes alkalies, magnesite, calcium carbide, sugar refining, whiting, fertilizer, rubber, paint (1971), and uses indicated by symbol W.

Table 7.—Ohio: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	6,788	8,595	7,158	9,519
Fill	1,364	1,218	1,563	1,178
Molding	207	719	171	566
Paving	7,814	9,620	8,765	11,080
Other uses [1]	771	1,589	393	981
Total [2]	16,946	21,741	18,050	23,323
Gravel:				
Building	7,065	10,007	8,406	12,302
Fill	1,485	1,206	1,743	1,629
Paving	13,802	19,047	14,094	20,801
Other uses [3]	1,242	1,789	983	1,648
Total [2]	23,598	32,050	25,226	36,379
Government-and-contractor operations:				
Sand:				
Building	--	--	9	13
Paving	89	93	92	101
Total [2]	89	93	100	114
Gravel:				
Building	3	5	--	--
Fill	5	1	10	10
Paving	162	154	119	106
Total [2]	169	160	129	116
Total sand and gravel [2]	40,797	54,044	53,506	59,932

[1] Includes railroad ballast, blast, engine, filtration, fire or funace, foundry, and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes miscellaneous, railroad ballast, and other gravel.

The Ohio Gravel division of the Dravo Corp. replaced its multiunit complex with a 900-ton-per-hour automated processing plant, located at Newton, Ohio. The plant was designed to produce 215 tons per hour of crushed gravel, 535 tons per hour of sand and gravel, and 150 tons per hour of subbase material. The plant was controlled from a central console, monitored by a closed-circuit TV system, and coordinated through use of a radio communications hookup.

Slag (Iron-Blast-Furnace).—Production of iron-blast-furnace slag was 5.3 million tons valued at $11.5 million, according to the National Slag Association. Output was 6.1% less than that of 1971; average unit price increased from $2.17 to $2.24 per ton, well above the National average of $2.13. Eighty-four percent of the total processed slag was screened air-cooled material; the remainder of granulated and lightweight (expanded) slag. The air-cooled slag was used chiefly as aggregate for concrete and bituminous construction, highway and airport construction, and as railroad ballast. Most of the granulated slag was used in highway construction. The chief use for expanded slag was as an aggregate in concrete-block and lightweight concrete. The State continued to rank second in production of processed slag, accounting for 21% of the National output.

Stone.—Production and value of stone (limestone, dolomite and sandstone) increased by 1.6 million tons and nearly $2.4 million in 1972. These increases were the result of increased activity in the various phases of highway and building construction and to the price increase for crushed and broken limestone.

Production of crushed and broken lime-

Table 8.—Ohio: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Ashland	6	197	199	5	W	W
Ashtabula	6	137	148	5	91	151
Auglaize	6	328	332	3	W	W
Butler	16	2,770	3,467	17	3,313	3,957
Champaign	4	W	W	4	217	301
Clark	11	1,458	1,665	9	1,427	1,649
Clinton	1	W	W	1	30	30
Columbiana	4	W	16	2	W	W
Coshocton	7	415	534	7	471	611
Cuyahoga	5	365	459	2	151	W
Erie	5	136	W	6	104	W
Fairfield	4	330	495	4	575	W
Franklin	14	4,503	6,641	15	5,546	8,370
Gallia	4	W	277	3	W	277
Geauga	8	1,012	1,591	6	643	1,199
Greene	10	865	1,025	11	1,362	1,624
Hamilton	17	W	W	15	4,472	6,262
Knox	5	557	753	5	725	896
Lake	4	216	369	4	W	W
Lawrence	3	W	W	3	223	282
Licking	7	1,088	1,244	9	1,017	1,178
Logan	4	122	W	4	146	206
Lorain	3	317	516	2	W	W
Lucas	6	715	613	5	686	801
Madison	3	W	265	4	216	276
Marion	4	248	298	3	167	W
Medina	6	615	845	5	W	W
Miami	8	668	839	7	754	941
Montgomery	17	2,550	3,273	16	2,752	3,659
Morrow	1	68	73	1	W	100
Pike	4	282	488	5	W	W
Portage	22	2,640	4,127	20	2,563	4,139
Richland	6	761	807	7	768	964
Ross	5	656	644	4	689	918
Scioto	4	W	W	4	120	166
Shelby	6	353	395	6	342	332
Stark	12	1,419	2,177	12	1,186	2,055
Summit	12	680	829	14	647	861
Trumbull	1	227	W	2	214	W
Tuscarawas	11	1,198	1,649	8	1,121	1,671
Warren	12	1,646	2,054	9	1,688	2,896
Washington	6	356	393	6	378	496
Wayne	4	519	655	4	660	332
Wyandot	5	223	271	5	262	287
Undistributed[1]	r 54	10,165	13,620	53	7,780	12,104
Total[2]	363	40,797	54,044	342	43,506	59,932

r Revised. W Withheld to avoid disclosing individual company confidential data; included in "Undistributed."

[1] Includes Allen, Athens, Brown, Carroll, Clermont, Crawford, Darke, Defiance, Delaware (1972), Henry, Hocking, Holmes, Huron, Mahoning, Meigs, Monroe, Morgan, Muskingum, Pickaway, Preble, Putnam, Sandusky (1972), Union, and Williams Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

stone (including dolomite) was approximately 5% more than that of 1971 and accounted for 98% of the State's total output of stone. The crushed and broken dolomite produced accounted for almost 12% of the State's total output and was 48% greater than that of 1971. The value of crushed and broken limestone was 11 cents higher than the $1.70 per ton received in the previous year, but crushed and broken dolomite was 13 cents below the $1.81-per-ton unit value of 1971. Of the 57 limestone-producing counties, Wyandot County led with output of 3.6 million tons. Erie, Mahoning, Lucas, and Franklin Counties were also important limestone producing areas.

Production of crushed and broken sandstone (including quartzite) totaled 921,384 tons valued at $2.7 million, representing a decrease of 630,749 tons in quantity and $4.1 million in value from that of the previous year. Production of dimension sandstone increased, but value decreased. Output was 86,715 tons valued at approximately $2.8 million compared with 76,082 tons and $4.1 million in 1971. The quantity of crushed and broken sandstone and quartzite produced in relationship to total stone production was approximately 2%. Sandstone was quarried in 11 counties; Geauga, Lorain, and Huron were the leading areas for crushed and broken stone; Lorain, Scioto, and Coshocton Counties led in production of dimension stone.

Marble Cliff Quarries Co. announced plans to build a new plant at its quarries west of the Scioto River, at Columbus, Ohio. The plant will produce specification materials and will have an annual capacity in excess of 2 million tons.

Sulfur (Recovered Elemental).—Production and sales of elemental sulfur recovered at the Toledo refinery of Sun Oil Co. and the Canton refinery were greater than that reported in 1971. The companies recovered sulfur by the catalytic oxidation of hydrogen sulfide.

Vermiculite (Exfoliated).—The Cleveland Gypsum Co., a division of Cleveland Builders Supply Co., processed crude vermiculite shipped from out-of-State at its Cleveland plant. Production and sales were equal to those of 1971. The exfoliated vermiculite was sold for fertilizer, soil conditioners, mill mixes, and other applications.

MINERAL FUELS

Coal (Bituminous).—Output of bituminous coal was 464,000 tons below that of the previous year, while value increased about $34.2 million, to $303.8 million. In terms of production and value, bituminous coal continued to be the State's principal mineral commodity. Strip mines supplied 67% of the total tonnage; underground mines supplied 32%, and auger mines supplied 1%. A total of 306 mines producing 1,000 tons or more were active, four more than

Table 9.—Ohio: Crushed and broken limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Bituminous aggregates	2,317	3,898	2,804	5,454
Concrete aggregates	7,702	11,667	6,520	10,427
Dense graded road base stone	5,288	8,027	4,499	7,048
Macadam aggregates	6,707	10,618	6,811	11,049
Surface treatment aggregates	1,237	1,912	1,582	2,701
Unspecified construction aggregate and road stone	4,338	6,930	6,653	12,332
Agricultural purposes	1,654	3,081	1,461	2,836
Cement manufacture	4,462	7,314	4,857	7,586
Dead-burned dolomite	1,205	2,121	1,303	2,318
Flux stone	3,567	5,824	3,640	5,925
Lime manufacture	2,569	5,903	2,650	5,757
Railroad ballast	750	1,077	973	1,435
Riprap and jetty stone	558	773	501	920
Stone sand	W	W	204	283
Other uses [1]	2,906	8,285	3,026	9,150
Total [2]	45,258	77,428	47,484	85,216

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes chemical and refractory stone, asphalt and other filler, dam construction (1971), glass manufacture, building products, filter stone (1971), and other uses in similar quantities.

[2] Data may not add to totals shown because of independent rounding.

in 1971. The number of underground mines active in the State remained at 35; strip mines decreased by one, and auger increased by five.

Strip-mined tonnage was 3.5 million tons below that of 1971 and totaled 34.1 million tons valued at $180 million. Average value per ton of strip-mined coal increased from $4.75 in 1971 to $5.29. Belmont County was the leading area in tonnage and accounted for 9 million tons, followed by Jefferson, Harrison, and Muskingum Counties with 4.8 million, 4.2 million, and 4.1 million tons, respectively. Coshocton and Tuscarawas Counties, each with production exceeding 1.8 million tons, also, were leading producing areas.

Twenty-one coal-cleaning and preparation plants were active, one more than in 1971. Producers cleaned 23.6 thousand tons by pneumatic methods and the remainder was cleaned by washing. Of the total tonnage cleaned, 76.0% was from underground mines, 23.7% from strip mines, and the remainder was from auger mines. Over 1.3 million tons of coal was dried after cleaning at four preparation plants. At mines having crushing and treatment facilities, 32.3 million tons of coal was crushed. Production at captive mines totaled 843 thousand tons compared with 4,474 thousand tons in 1971. Of the State's total coal output, 32.8 million tons were shipped by rail or water, 12.5 million tons by truck, and the rest was consumed locally.

The State's coal-mine fatal injury rate of 0.15 per million short tons was the second lowest in the Nation and was well below the national average of 0.26. Work fatalities totaled eight and nonfatal injuries totaled 738. Of the eight fatalities that occurred during the year, three were at underground mines, four were at strip mines, and one was at an auger mine. The underground fatalities were the result of haulage, machinery, and roof fall accidents. The strip mine fatalities were the result of haulage, machinery, and highwall slide accidents, and the auger mine fatality was a material-handling accident.

In National Safety Competition the Georgetown No. 24 mine and the Bradford No. 16 mine operated by the Consolidation Coal Co., Hanna Coal Division, were winners of the surface coal group competition. The Georgetown No. 24 mine was worked 153,198 man-hours and the Bradford No. 16 mine was worked 151,626 man-hours without any disabling injuries.

Coke and Coal Chemicals.—Production of

Table 10.—Ohio: Bituminous coal production, by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total [1]	
Athens	--	1	--	1	--	1	--	1	W
Belmont	9	29	3	41	7,711	9,012	53	16,776	$105,016
Carroll	--	6	2	8	--	420	6	426	2,180
Columbiana	3	24	4	31	29	826	138	1,028	5,140
Coshocton	2	7	3	12	469	1,922	180	2,570	18,176
Gallia	--	3	--	3	--	90	--	90	302
Guernsey	1	6	--	7	369	772	--	1,142	6,088
Harrison	5	19	3	27	3,511	4,208	66	7,785	49,808
Hocking	--	7	1	8	--	165	2	167	789
Holmes	--	6	--	6	--	753	--	753	3,398
Jackson	4	9	2	15	327	1,065	17	1,409	5,905
Jefferson	2	33	7	42	852	4,819	105	5,777	32,790
Lawrence	--	2	--	2	--	48	--	48	W
Mahoning	--	7	1	8	--	389	1	388	2,185
Meigs	1	--	--	1	29	--	--	29	W
Monroe	1	--	--	1	691	--	--	691	W
Morgan	--	2	--	2	--	691	--	691	W
Muskingum	1	7	1	9	42	4,142	8	4,192	25,250
Noble	--	4	--	4	--	957	--	957	4,559
Perry	4	12	2	18	2,171	745	9	2,925	16,600
Stark	--	11	3	14	--	346	9	355	1,638
Tuscarawas	2	30	3	35	70	1,852	27	1,948	9,615
Vinton	--	8	--	8	--	581	--	581	3,162
Washington	--	2	--	2	--	206	--	206	W
Wayne	--	1	--	1	--	31	--	31	W
Undistributed	--	--	--	--	--	--	--	--	11,219
Total	35	236	35	306	[1] 16,269	34,077	621	50,967	303,819

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Data may not add to totals shown because of independent rounding.

oven-coke in Ohio was 17% above that of 1971 and totaled 8.9 million tons valued at $292 million.

Peat.—Shipments and value were below those of 1971, but higher unit prices were reported. The average value of peat was increased from $14.00 per ton in 1971 to $16.75. Production was reported in seven counties; Richland County with one operation ranked first in tonnage. Of the total sales, 52% was moss peat, 34% was humus, and 14% was reed-sedge peat. Approximately 82% of the peat was sold in bulk for general soil improvement. The rest was sold for a variety of uses, the most important being as an ingredient for potting soils.

Petroleum and Natural Gas.—Production and value of both petroleum and natural gas were greater than that of 1971. According to the American Petroleum Institute, total well completions and footage drilled increased from 1,157 to 1,331 wells and 4,577,483 to 5,301,296 feet respectively. A total of 1,276 development and 55 wildcat completions were reported. Development wells were drilled in 41 counties; Muskingum, Tuscarawas, Guernsey, and Perry were the leading areas. Wildcat completions were reported in 31 counties. The leading area for wildcat activity was Geauga County.

Reserves on December 31, 1971, were 1,146,677 million cubic feet of natural gas (14.73 pounds per square inch absolute, at 60° F) and 127 million barrels of crude petroleum), according to the American Gas Association and the American Petroleum Institute. Compared with the end of 1971, reserves of natural gas were increased 78,305 million cubic feet and reserves of crude petroleum were reduced 1,759 million barrels. Of the natural gas reserves, 431,526 million cubic feet was held in underground storage.

The total crude capacity of the refineries as of January 1, 1972, was 525,900 barrels per calendar day, 12,400 barrels more than in 1971. Cracking, reforming, coking, and alkylation capacity expressed in terms of gasoline output, totaled 285,090 barrels per calendar day compared with 285,162 barrels the previous year. Other products recovered at the refineries included asphalt, coke, lubricant, and paraffin. Refineries were operated at Canton, Findlay, Cincinnati, Cleaves, Lima, and Toledo.

METALS

Aluminum.—Compared with 1971, output of primary aluminum at the Hannibal reduction plant of Ormet Corp. increased, but value decreased because of lower unit prices. Ormet Corp., jointly owned by Olin Corp. (formerly Olin-Mathieson Chemical Corp.) and Revere Copper & Brass, Inc., reduced alumina obtained by barge from a company-owned plant at Burnside, La.

Beryllium.—Beryllium metal, alloys, and compounds were produced from beryllium hydroxide by the Brush Beryllium Corp., at Elmore. Bertrandite ore mined at the corporation's Roadside mine near Delta, Utah, was processed into beryllium hydroxide and shipped to the Elmore plant. Production was mostly beryllium and beryllium-copper master alloy.

Ferroalloys.—Ohio continued as the leading producer among the 16 ferroalloy-producing States. Shipments were 12% above those of the previous year. Production consisted mainly of ferroalloys of boron, chromium, columbium, manganese, and silvery pig iron.

Iron and Steel.—Steel production at Ohio plants was 23.8 million short tons, 18.9% above that of 1971, according to the American Iron and Steel Institute. Production of pig iron was 16.4 million tons, 2.7 million tons above that of 1971. Pig iron shipments increased slightly and totaled 16.5 million tons valued at $1.3 billion. Of the 43 blast furnaces in the State, 29 were active and 14 were idle. Ohio plants received 5 million tons of domestic iron ore and 1.9 million tons of imported iron ore. Iron ore receipts were 1.6 million tons more than those of 1971. Receipts of agglomerates increased 1.7 million tons and totaled 16.6 million tons. Of the agglomerated material, 15.6 million tons were domestic regular iron ore pellets.

Blast furnaces consumed 4.7 million tons of domestic and 0.8 million tons of foreign iron ore as well as 1.8 million tons of agglomerates. In addition, 2.2 million tons of limestone and 1.2 million tons of dolomite were consumed as fluxing material. Tonnages of other materials consumed included coke and coke breeze, 10.3 million; home and purchased scrap, 588,000; slag scrap, 97,100; mill cinder and roll scale 563,000; open-hearth, basic oxygen, and Bessemer slag, 641,000; and flute dust, 18,000. Approximately 3.2 million tons of slag and

185,000 tons of scrap iron were produced at blast furnaces, and 702,000 tons of flue dust were recovered. Blast furnaces consumed substantial quantities of supplemental fuels including natural gas, bunker oil, and fuel tar.

Titanium.—The RMI Company produced titanium sponge metal by sodium reduction of titanium tetrachloride at its Ashtabula plant. The company's Niles plant for melting and processing titanium sponge was reopened in April 1972. The Cabot Titanium Corp. leased its titanium pigment operation at Ashtabula to the New Jersey Zinc Co. The Sherwin-Williams Co. continued to produce titanium pigments (titanium dioxide) used in manufacturing paint and also made plans to produce synthetic rutile.

Zirconium.—Foote Mineral Company processed zircon at its Cambridge plant to produce magnesium-zirconium alloys called "Grainals." Harshaw Chemical Co., Inc., recovered zirconium oxide at its Cleveland plant for use as ceramic-base colors. Ohio Ferro-Alloys Corp. produced zirconia-silicon alloys at Brilliant. Zirconium Corp. of America produced zirconium oxide as well as zirconia refractories at its Cleveland plant. The Chas. Taylor Sons Co. of Cincinnati produced zircon refractories. Continental Minerals Processing Corp. milled zircon at Sharonville for use by the iron and steel foundries and the ceramic industry. TRW Inc. produced zircon concentrate in Cleveland for sand blasting metals, and Sherwood Refractories Co. milled zircon, for use by the iron and steel foundaries.

Table 11.—Ohio: Oil and gas well drilling in 1972, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Ashland	4	--	4	--	1	1	9	12,646
Ashtabula	5	38	3	--	3	--	49	165,825
Athens	9	16	5	--	1	1	32	57,660
Auglaize	--	--	--	--	--	1	1	3,067
Belmont	--	--	1	--	1	--	2	4,475
Carroll	53	--	1	--	--	1	55	296,664
Columbiana	--	1	--	--	--	1	2	18,253
Coshocton	17	14	9	1	1	3	45	167,358
Darke	--	--	--	--	--	1	1	1,729
Defiance	--	--	--	--	--	1	1	2,612
Delaware	--	--	--	--	--	1	1	3,473
Fairfield	5	--	2	--	--	--	7	17,507
Fulton	--	--	1	--	--	1	2	3,622
Geauga	--	16	--	--	7	--	23	93,864
Guernsey	10	71	11	--	--	--	92	457,675
Harrison	3	34	1	--	2	--	40	226,131
Henry	--	1	--	--	--	--	1	1,610
Highland	--	--	--	--	--	1	1	3,610
Hocking	28	4	2	--	--	--	34	98,515
Holmes	18	51	5	--	1	1	76	280,209
Jackson	--	1	--	--	1	--	2	1,080
Knox	17	5	5	--	--	--	27	75,029
Lake	--	--	--	--	1	--	1	3,030
Lawrence	--	--	1	--	--	2	3	12,081
Licking	33	2	2	--	--	--	37	108,954
Lorain	--	--	1	--	--	--	1	1,965
Lucas	--	--	--	--	--	1	1	3,915
Mahoning	--	9	--	--	--	--	9	45,275
Marion	--	--	1	--	--	--	1	2,437
Medina	--	9	4	--	--	--	13	44,623
Meigs	1	13	5	--	1	--	20	52,353
Mercer	1	--	--	--	--	--	1	3,215
Monroe	--	9	1	--	--	--	10	19,867
Morgan	5	41	4	--	--	2	52	143,228
Morrow	3	1	20	--	--	--	24	72,664
Muskingum	58	111	26	--	--	1	196	815,639
Noble	--	50	4	--	--	--	54	293,951
Perry	59	17	6	--	--	2	84	262,349
Portage	7	--	1	1	--	--	9	41,851
Richland	--	--	8	--	--	2	10	17,554
Scioto	--	1	--	--	--	--	1	363
Stark	51	25	3	--	--	--	79	331,875
Trumbull	--	3	--	--	4	--	7	32,748
Tuscarawas	25	125	2	--	1	--	153	792,006
Vinton	1	2	3	--	--	--	6	12,100
Washington	5	22	2	--	--	1	30	51,596
Wayne	6	5	10	--	--	1	22	81,348
Williams	--	--	--	--	--	3	3	10,801
Wood	--	--	1	--	--	--	1	1,294
Total	424	697	155	2	24	29	1,331	5,301,296

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 12.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasives: Metallic:			
Cleveland Metal Abrasive Co., Division of Fanner Manufacturing Co.	Brookside Park Cleveland, Ohio 41090	Plant	Cuyahoga.
Do		do	Lucas.
Globe Steel Abrasives Co	P.O. Box 1247, P.O. Annex Mansfield, Ohio 44903	do	Richland.
Metal Blast, Inc	871 East 67th St. Cleveland, Ohio 44103	do	Cuyahoga.
National Metal Abrasive Co	3560 Norton Rd. Cleveland, Ohio 44111	do	Do.
Steel Abrasives, Inc	Hamilton, Ohio 45010	do	Butler.
Cement:			
Columbia Cement Corp., a subsidiary of PPG Industries Inc. [4]	P.O. Box 31 Barberton, Ohio 44203	do	Summit.
Diamond Div., Flintkote Co	Middle Branch, Ohio 44652	do	Stark.
Peninsular Div., General Portland Cement Co. [1]	709 Clay St. Ft. Wayne, Ind. 46802	do	Paulding.
Marquette Cement Manufacturing Co. [3]	20 North Wacker Dr. Chicago, Ill. 60606	do	Lawrence.
Medusa Corp [3]	P.O. Box 5668 Cleveland, Ohio 44101	do	Lucas.
Southwestern Portland Cement Co. [1]	P.O. Box 191 Fairborn, Ohio 45324	do	Greene.
Universal Atlas Cement Div., [1] United States Steel Corp.	Pittsburgh, Pa. 15230	do	Do.
Clays:			
Fire clay:			
Cedar Heights Clay Co	P.O. Box 368 Oak Hill, Ohio 45656	4 pits	Jackson.
Metropolitan Industries, Inc.	306 Market Ave. North Canton, Ohio 44702	Pit	Columbiana.
H. K. Porter Company, Inc.	Porter Bldg. Pittsburgh, Pa. 15219	2 underground mines.	Columbiana and Jefferson.
Common clay and shale:			
Belden Brick Co [5]	P.O. Box 910 Canton, Ohio 44701	7 pits	Holmes and Tuscarawas.
Bessmer Cement Co	510 Hanna Bldg. Cleveland, Ohio 44115	Pit	Mahoning.
General Portland Inc	709 Clay St. Fort Wayne, Ind. 46802	Pit	Paulding.
Hydraulic Press Brick Co	705 Olive St. St. Louis, Mo. 63101	Pit	Cuyahoga.
Medusa Corp	P.O. Box 5668 Cleveland, Ohio 44101	Pit	Lucas.
The Richland Brick Co	Box 328 Mansfield, Ohio 44901	2 pits	Richland.
Southwestern Portland Cement Co.	Box 191 Fairborn, Ohio 45329	Pit	Greene.
Coal (bituminous):			
B & N Coal Co	Box 100 Dexter City, Ohio 45727	2 strip mines	Noble.
Boich Mining Co	R.D. 1 Bloomingdale, Ohio 43910	do	Jefferson and Muskingum.
Central Ohio Coal Co	Box 18, Bowling Green Station New York, N.Y. 10004	Strip	Morgan and Muskingum.
Cravat Coal Co	Box 157 Holloway, Ohio 43985	3 strip mines	Belmont and Harrison.
Do		Underground	Belmont.
Cross Creek Coal Co	Box 167 New Philadelphia, Ohio 44663	Strip	Tuscarawas.
Hanna Coal Co., division of Consolidation Coal Co.	Cadiz, Ohio 43907	5 strip mines	Belmont, Jefferson, Harrison.
Do		Auger	Do.
Do		Underground	Harrison.
Hardy Coal Co	Berlin, Ohio 44610	4 strip mines	Coshocton, Holmes, Tuscarawas.
North American Coal Corp	12800 Shaker Boulevard Cleveland, Ohio 44120	3 underground mines.	Belmont and Jefferson.
Do [6]		do	Monroe and Belmont.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal (bituminous)—Continued			
Oglebay Norton Co	1200 Hanna Bldg. Cleveland, Ohio 44115	2 underground mines.	Belmont.
Ohio River Collieries Co	Route 1 Bloomingdale, Ohio 43910	Strip	Do.
Do		Auger	Do.
Peabody Coal Co	301 North Memorial Drive St. Louis, Mo. 63102	2 strip mines	Coshocton and Perry.
Do		Underground	Perry.
R. & F. Coal Co	Box 218, Cadiz, Ohio 43907	5 strip mines	Belmont, Harrison, Noble.
Simco-Peabody Coal Co.	301 North Memorial Drive St. Louis, Mo. 63102	do	Coshocton.
Do		Underground	Do.
Youghiogheny & Ohio Coal Co.	4614 Prospect Ave. Cleveland, Ohio 44103	3 underground mines.	Belmont and Harrison.
Ferroalloys:			
Foote Mineral Co	Route 100 Exton, Pa. 19341	2 plants	Guernsey and Jefferson.
Interlake Steel Corp	13 - 5th & Perry Ave. Chicago, Ill. 60604	do	Washington.
Ohio Ferro-Alloys Corp	839 30th Northwest Canton, Ohio 44709	do	Jefferson and Muskingum.
Union Carbide Corp	P.O. Box 176 Marietta, Ohio 45750	do	Ashtabula and Washington.
Graphite (synthetic): Ohio Carbon Co.	12508 Berea Rd. Cleveland, Ohio 44111	do	Cuyahoga.
Gypsum:			
Crude:			
Celotex Corp[7]	1500 North Dale Mabry Tampa, Fla. 33607	Pit	Ottawa.
United States Gypsum Co.[7]	101 South Wacker Dr. Chicago, Ill. 60606	Underground	Do.
Calcined: National Gypsum Co.	325 Delaware Ave. Buffalo, N.Y. 14202	Plant	Lorain.
Lime:			
Basic Inc	845 Hanna Bldg. Cleveland, Ohio 44115	do	Seneca.
Cuyahoga Lime Co	Menlo Park, N. J. 08817	do	Cuyahoga.
Diamond Shamrock Chemical Co., Unit of Diamond Shamrock Corp.	300 Union Commerce Bldg. Cleveland, Ohio 44115	do	Lake.
National Lime & Stone Co	First National Bank Bldg. Findlay, Ohio 45840	do	Wyandot.
Huron Lime Co	P.O. Box 428 Huron, Ohio 45840	do	Erie.
Ohio Lime Co	Woodville, Ohio 43469	do	Sandusky.
Pfizer, Inc	836 National Bank Bldg Toledo, Ohio 43604	do	Do.
PPG Industries, Inc	Barberton, Ohio 44203	do	Summit.
Republic Steel Corp	Box 6778 Cleveland, Ohio 44101	do	Lake.
Standard Lime & Refractories Co., Division of Martin Marietta Corp.	Executive Plaza II Hunt Valley, Md. 21030	do	Sandusky.
Union Carbide Corp., Chemicals & Plastics.	P.O. Box 299 Marietta, Ohio 45750	do	Ashtabula.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Ottawa.
United States Steel Corp	600 Grant St. Pittsburgh, Pa. 15230	do	Lorain.
Peat:			
Correll Peat Moss	Box 340, Rt. 1 Beach City, Ohio 44608	Bog	Stark.
Humus Co	2628 South Michigan St. South Bend, Ind. 46614	Bog	Wyandot.
Lingvai Peat Co	Rte. 2, Box 82 Edgerton, Ohio 43517	Bog	Williams.
Reynolds Farms, Inc	Route 1 Shelby, Ohio 44875	Bog	Richland.
W. C. Utzinger & Sons	6268 Jackson Pike Grove City, Ohio 43123	Bog	Franklin.
Perlite (expanded):			
Cleveland Gypsum Co., a division of Cleveland Builders Supply Co.[8]	2100 West Third St. Cleveland, Ohio 44113	Plant	Cuyahoga.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Perlite (expanded)—Continued			
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	Plant	Lorain.
Celotex Corp	320 South Wayne Ave. Cincinnati, Ohio 45215	do	Hamilton.
Petroleum refineries:			
Ashland Oil and Refining Co.	1409 Winchester Ave. Ashland, Ky. 41101	2 plants	Hancock and Stark.
Chevron Asphalt Co	555 Market St. San Francisco, Calif. 94105	Plant	Hamilton.
Gulf Oil Corp	Pittsburgh, Pa. 15219	2 plants	Hamilton and Lucas.
Standard Oil Co. of Ohio	Midland Bldg. Cleveland, Ohio 44115	do	Allen and Lucas.
Sun Oil Co[9]	1608 Walnut St. Philadelphia, Pa. 19103	Plant	Lucas.
Salt:			
Brine:			
Diamond Shamrock Chemical Co., Unit of Diamond Shamrock Corp.	300 Union Commerce Bldg. Cleveland, Ohio 44115	Well	Lake.
PPG Industries, Inc[10]	P.O. Box 31 Barberton, Ohio 44203	do	Summit.
Evaporated:			
Diamond Crystal Salt Co.[11]	916 South Riverside St. Clair, Mich. 48079	do	Do.
Excelsior Salt Works, Inc.	P.O. Box 267 Pomeroy, Ohio 45769	do	Meigs.
Morton Salt Co., a division of Morton International, Inc.	110 North Wacker Dr. Chicago, Ill. 60606	do	Wayne.
Rock:			
International Salt Co[10]	Clarks Summit, Pa. 18411	Underground	Cuyahoga.
Morton Salt Co., a division of Morton International, Inc.	110 North Wacker Dr. Chicago, Ill. 60606	do	Lake.
Sand and gravel:			
American Aggregates Corp	Garst Ave. at Ave. B Greenville, Ohio 45331	9 pits	Champaign, Clark, Darke, Franklin, Licking, Montgomery.
Do		Dredge	Clark.
American Materials Corp	P.O. Box 154 Hamilton, Ohio 45010	2 pits	Butler.
Do		Pit	Hamilton.
F. H. Brewer Co	P.O. Box 128 Lancaster, Ohio 43130	2 pits	Athens and Fairfield.
Hilltop Concrete Corp	Lane Avenue Cincinnati, Ohio 45214	do	Greene and Montgomery.
Moraine Materials Co	2500 East River Road Dayton, Ohio 45409	do	Montgomery.
Morrow Gravel Co	3535 Round Bottom Road Cincinnati, Ohio 45244	Pit	Warren.
Ohio Gravel Co., a division of Dravo Corp.	5253 Wooster Road Cincinnati, Ohio 45226	7 pits	Butler, Hamilton, Warren.
Richard & Son Inc	P.O. Box 232 Pomeroy, Ohio 45769	Plant	Meigs.
Standard Slag Co	1200 Stambaugh Bldg. Youngstown, Ohio 44501	3 pits	Pike and Scioto.
Tri-State Materials Corp	Box 1933 Parkersburg, W. Va. 26100	Pit	Meigs.
Smelters:			
Aluminum: Ormet Corp		Plant	Monroe.
Titanium sponge: Reactive Metals, Inc.		do	Ashtabula.
Zinc: American Zinc Co		do	Franklin.
Stone:			
Dolomite (crushed and broken):			
Basic Inc	845 Hanna Bldg. Cleveland, Ohio 44115	Quarry	Seneca.
Standard Lime & Refractories Co., a division Martin-Marietta Corp.	2000 First National Bank Bldg. Baltimore, Md. 21203	do	Sandusky.
Woodville Lime & Chemical Co.	Box 218 Woodville, Ohio 43316	do	Do.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Limestone (crushed and broken):			
American Aggregates Corp.	Garst Ave. at Ave. B Greenville, Ohio 45331	4 quarries	Montgomery.
Carbon Limestone Co	Lowellville, Ohio 44436	do	Mahoning.
Davon, Inc	Box 5765 Columbus, Ohio 43221	2 quarries	Adams.
France Stone Co	1800 Toledo Trust Bldg. Toledo, Ohio 43604	4 quarries	Lucas, Sandusky, Seneca, Wood.
Marble Cliff Quarries Co.	2100 Tremont Center Columbus, Ohio 43221	3 quarries	Delaware, Franklin, Preble.
Maumee Stone Co	P.O. Box 369 Maumee, Ohio 43537	4 quarries	Lucas, Paulding, Wood.
National Lime & Stone Co.	First National Bank Bldg. Findlay, Ohio 45840	8 quarries	Allen, Auglaize, Crawford, Delaware, Hancock, Marion, Putnam, Wyandot.
PPG Industries, Inc	P.O. 31 Barberton, Ohio 44203	Quarry	Summit.
Sandusky Crushed Stone Co., Inc.	P.O. Box 527 Sandusky, Ohio 44870	do	Erie.
Standard Slag Co	1200 Stambaugh Bldg. Youngstown, Ohio 44501	2 quarries	Mahoning and Ottawa.
Limestone (dimension):			
Gregory Stone Co., Inc.	1860 N. Gettysburg St. Ludlow Falls, Ohio 45339	do	Miami.
E. R. Lintner Co	Rt. 3, Flat Rock Rd. Bellevue, Ohio 44811	do	Seneca.
Quartzite (crushed):			
Sharon Silica Co	Rte. 2 Jackson, Ohio 45640	do	Pike.
R. W. Sidley, Inc	R.F.D. 1 Thompson, Ohio 44086	do	Geauga.
Sperry Road Sand and Gravel Co.	R.D. 4, Hobart Rd. Willoughby, Ohio 44094	do	Lake.
United States Gypsum Co.	101 South Wacker Drive Chicago, Ill. 60606	Quarries	Greene and Ottawa.
Sandstone (crushed and broken):			
Alan Stone Co. Inc	P.O. Box 127 Chesterhill, Ohio 43728	do	Monroe and Washington.
Cannon Sand & Rock Co., Inc.	Box 65 Twinsburg, Ohio 44087	Quarry	Summit.
Cleveland Quarries Co	Amhurst, Ohio 44001	Quarries	Erie and Lorain.
Mesenburg Bros. Inc	Collins, Ohio 44826	Quarry	Huron.
PPG Industries. Inc	P.O. Box 31 Barberton, Ohio 44203	do	Summit.
Sandstone (dimension):			
Briar Hill Stone Co	Glenmont, Ohio 44628	10 quarries	Coshocton, Holmes, Knox.
Cleveland Quarries Co[12]	Amherst, Ohio 44001	7 quarries	Erie and Lorain.
Conotton Valley Quarries	P.O. Box 189 Sherrodsville, Ohio	Quarry	Carroll.
Taylor Stone Co	McDermott, Ohio 45652	do	Scioto.
Waller Brothers Stone Co.		3 quarries	Do.

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[1] Also clay and limestone.
[2] Also clay and cement rock.
[3] Also sand shale, and limestone.
[4] Also limestone.
[5] Also shale.
[6] One operation in two counties.
[7] Also calcined.
[8] Also exfoliated vermiculite.
[9] Also byproduct sulfur.
[10] Also evaporated salt.
[11] Also brine.
[12] Also grindstones and crushed and broken sandstone.

The Mineral Industry of Oklahoma

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Oklahoma Geological Survey for collecting information on all minerals except fuels.

By L. G. Southard,[1] K. S. Johnson,[2] and J. F. Roberts [2]

Oklahoma mineral output value in 1972 was $1,211 million, a 1.8% increase over 1971. Oklahoma ranked sixth in the nation in domestic mineral production value, and for the sixth consecutive year, value exceeded $1 billion. Mineral fuels provided 93.3% of the total value of mineral output. Gains in value were made in all mineral fuels with the exception of crude petroleum. Nonmetallic minerals supplied 6.3% of the total value of all minerals produced in 1972. Value of metals recorded a net loss of 4.5% below the value in 1971.

Employment and Wages.—The Oklahoma Employment Security Commission reported 37,300 persons employed in the mineral industry in 1972 compared with 36,700 (revised) in 1971. The petroleum industry accounted for 94% of the State's mineral industry employment. Average total number of persons employed in other phases of the mineral industry amounted to 2,200. The average hourly wage paid in the mineral industry was $3.70, an increase of 3.4% over that of 1971.

Table 1.—Mineral production in Oklahoma [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays [2] .... thousand short tons	845	$1,255	938	$1,398
Coal (bituminous) .... do	2,234	15,004	2,624	19,112
Gypsum .... do	1,022	3,073	1,196	3,888
Helium:				
High-purity .... million cubic feet	123	4,305	174	6,090
Crude .... do	270	3,240	163	1,956
Natural gas .... do	1,684,260	273,945	1,806,887	294,528
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	14,197	40,856	14,559	42,709
LP gases .... do	27,540	56,732	27,148	57,011
Petroleum (crude) .... do	213,313	725,611	207,633	709,033
Sand and gravel .... thousand short tons	5,713	8,259	[3] 7,901	[3] 11,138
Stone .... do	19,449	27,125	19,448	26,574
Zinc (recoverable content of ores, etc.) .... short tons	(4)	(4)	W	W
Value of items that cannot be disclosed:				
Cement, clays (bentonite), copper, lime, pumice, salt, silver, tripoli, and value indicated by symbol W	XX	30,111	XX	37,296
Total	XX	1,189,516	XX	1,210,728
Total 1967 constant dollars	XX	1,011,445	XX	[p] 1,007,205

[p] Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes bentonite; included with "Value of items that cannot be disclosed."

[3] Data not directly comparable with previous years because of increased industry coverage.

[4] Less than ½ unit.

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[1] Mineral specialist, Division of Fossil Fuels.

[2] Geologist, Oklahoma Geological Survey, Norman, Okla.

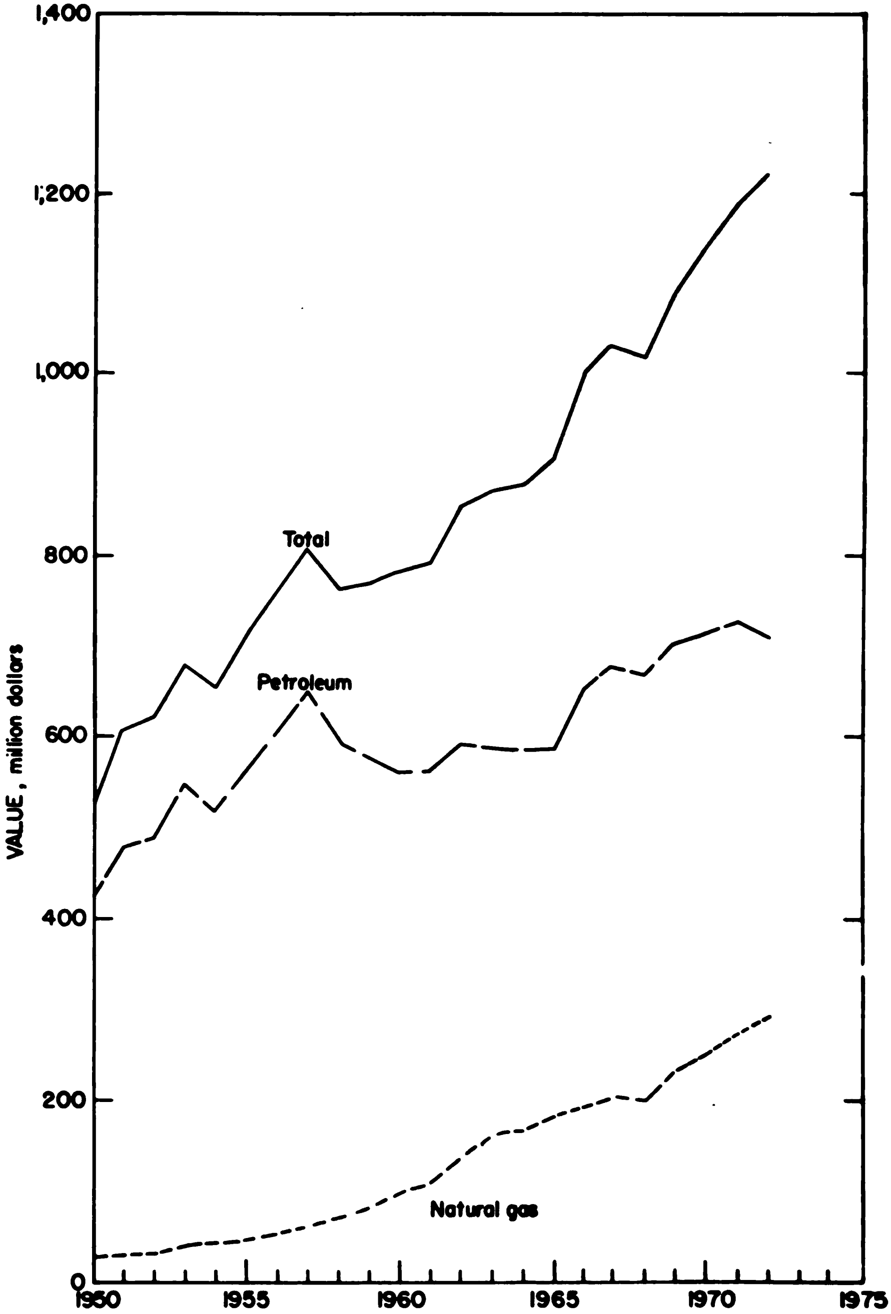

Figure 1.—Value of natural gas, petroleum, and total value of mineral production in Oklahoma.

Table 2.—Value of mineral production in Oklahoma, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Alfalfa	$7,033	$8,127	Petroleum, natural gas, natural gas liquids, sand and gravel.
Atoka	W	656	Stone, sand and gravel.
Beaver	53,906	48,566	Natural gas, petroleum, natural gas liquids, pumice.
Beckham	9,467	7,395	Natural gas, natural gas liquids, petroleum.
Blaine	18,903	20,024	Natural gas, petroleum, gypsum, natural gas liquids.
Bryan	3,010	2,195	Petroleum, natural gas, sand and gravel, stone.
Caddo	22,136	21,992	Petroleum, natural gas, gypsum, natural gas liquids, stone.
Canadian	7,017	12,662	Natural gas, petroleum, sand and gravel, clays, gypsum.
Carter	81,588	85,059	Petroleum, natural gas, natural gas liquids, stone, sand and gravel.
Cherokee	W	W	Stone.
Choctaw	W	35	Sand and gravel.
Cimarron	16,994	18,315	Helium, natural gas, petroleum, natural gas liquids.
Cleveland	15,426	13,405	Petroleum, natural gas, natural gas liquids.
Coal	2,021	1,941	Natural gas, petroleum, stone.
Comanche	3,800	4,586	Stone, gypsum, petroleum, natural gas.
Cotton	W	W	Petroleum, sand and gravel, natural gas.
Craig	W	W	Coal, stone, petroleum, natural gas.
Creek	34,731	31,138	Petroleum, stone, natural gas liquids, natural gas, clays.
Custer	5,636	5,876	Natural gas, natural gas liquids, petroleum, clays.
Dewey	28,818	30,449	Natural gas, petroleum, natural gas liquids, clays.
Ellis	9,435	8,375	Natural gas, petroleum.
Garfield	30,373	28,565	Petroleum, natural gas, natural gas liquids, sand and gravel.
Garvin	77,748	77,218	Petroleum, natural gas liquids, natural gas.
Grady	36,211	61,006	Petroleum, natural gas, natural gas liquids.
Grant	4,941	5,002	Do.
Greer	252	276	Stone, petroleum, natural gas, clays, sand and gravel.
Harmon	W	--	
Harper	23,968	24,608	Natural gas, natural gas liquids, petroleum.
Haskell	11,290	W	Natural gas, coal.
Hughes	15,791	4,676	Petroleum, natural gas, stone.
Jackson	4,372	8,885	Copper, gypsum, petroleum, sand and gravel, silver, zinc, natural gas.
Jefferson	2,270	2,215	Petroleum, natural gas.
Johnston	W	W	Sand and gravel, stone.
Kay	15,383	15,243	Petroleum, natural gas liquids, natural gas, sand and gravel.
Kingfisher	70,873	70,497	Petroleum, natural gas, natural gas liquids, sand and gravel.
Kiowa	1,709	1,411	Stone, petroleum, natural gas.
Latimer	W	16,326	Natural gas.
Le Flore	8,058	6,984	Natural gas, coal, clays, sand and gravel.
Lincoln	10,028	9,013	Petroleum, natural gas, natural gas liquids, stone.
Logan	7,749	7,066	Do.
Love	6,029	7,014	Petroleum, natural gas, natural gas liquids.
McClain	25,477	22,991	Petroleum, natural gas, natural gas liquids, sand and gravel.
McCurtain	W	197	Sand and gravel.
McIntosh	W	793	Natural gas, stone, petroleum.
Major	41,206	44,285	Petroleum, natural gas, natural gas liquids, sand and gravel.
Marshall	6,543	5,919	Petroleum, natural gas liquids, natural gas, sand and gravel.
Mayes	W	W	Cement, stone, clays, petroleum.
Murray	6,939	7,801	Stone, petroleum, sand and gravel, natural gas.
Muskogee	1,575	2,985	Coal, petroleum, sand and gravel.
Noble	6,089	5,737	Petroleum, natural gas.
Nowata	1,625	1,822	Petroleum, coal, stone, natural gas.
Okfuskee	4,227	3,856	Petroleum, natural gas, natural gas liquids.
Oklahoma	20,912	23,253	Petroleum, natural gas liquids, natural gas, sand and gravel, clays.
Okmulgee	3,615	3,321	Petroleum, stone, natural gas.
Osage	43,581	43,845	Do.
Ottawa	W	W	Stone, tripoli.
Pawnee	5,910	5,072	Petroleum, stone, sand and gravel, natural gas.
Payne	10,010	8,761	Petroleum, stone, natural gas, sand and gravel.
Pittsburg	8,315	9,673	Natural gas, coal, stone, clays, sand and gravel.
Pontotoc	23,296	29,335	Cement, petroleum, stone, sand and gravel, natural gas, clays, natural gas liquids.
Pottawatomie	8,692	8,396	Petroleum, natural gas, sand and gravel, stone.
Pushmataha	1	--	
Roger Mills	W	2,193	Natural gas, petroleum.
Rogers	14,431	16,170	Cement, coal, petroleum, stone, clays, natural gas.
Seminole	32,714	29,917	Petroleum, natural gas liquids, natural gas, stone, clays, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Oklahoma, by county[1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Sequoyah	$5,267	$5,487	Lime, natural gas, stone.
Stephens	100,440	99,665	Petroleum, natural gas, natural gas liquids.
Texas	90,657	90,565	Natural gas, petroleum, natural gas liquids, sand and gravel.
Tillman	2,178	W	Petroleum, sand and gravel.
Tulsa	7,562	10,067	Stone, petroleum, sand and gravel, clays, natural gas.
Wagoner	392	348	Petroleum, natural gas.
Washington	8,769	2,892	Petroleum, stone, natural gas.
Washita	W	581	Natural gas, petroleum, gypsum.
Woods	11,702	12,458	Natural gas, petroleum, salt.
Woodward	11,981	13,487	Natural gas, natural gas liquids, petroleum, sand and gravel.
Undistributed[2]	43,494	37,105	
Total	[3] 1,189,516	1,210,728	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Adair and Delaware Counties are not listed because no production was reported.

[2] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[3] Data does not add to total shown because of independent rounding.

Table 3.—Indicators of Oklahoma business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force thousands	1,063.0	1,087.6	+2.3
Unemployment do	52.9	52.1	−1.5
Employment:			
Construction do	38.8	40.1	+3.4
Manufacturing do	131.3	138.9	+5.8
Mining do	36.7	37.3	+1.6
Other[1] do	573.0	590.4	+3.0
Personal income:			
Total millions	$9,140	$10,015	+9.6
Per capita	$3,515	$3,802	+8.2
Construction activity:			
Contracts awarded:			
Residential millions	$510.5	$635.0	+24.4
Nonresidential do	$238.5	$331.4	+39.0
Nonbuilding do	$265.0	$454.3	+71.4
Cement shipments to and within Oklahoma thousand short tons	1,216	1,398	+15.0
Mineral production value millions	$1,189.5	$1,210.7	+1.8

p Preliminary.

[1] Includes services; wholesale and retail trade; finance, insurance, and real estate; transportation and public utilities; and government.

Sources: Oklahoma Business Bureau, Survey of Current Business, Area Trends in Employment and Unemployment, Employment and Earnings and Annual Report on the Labor Force, and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	561	234	131	1,032	3	47	48.44	NA
Metal	169	240	41	325	--	14	43.07	1,864
Nonmetal	481	259	125	1,000	--	39	39.00	1,426
Sand and gravel	377	242	91	807	--	16	19.84	216
Stone	1,397	270	378	3,113	1	90	29.23	4,622
Total	2,985	256	[1] 765	6,277	4	206	33.46	NA
1972:[2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	120	238	28	227	--	9	39.63	1,070
Nonmetal	445	286	127	1,039	--	15	14.44	390
Sand and gravel	330	246	81	709	--	15	21.14	430
Stone	1,165	276	322	2,665	--	68	25.51	741
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data does not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

Environmental Activities.—The State Board of Health approved nine new air pollution regulations and amendments to three existing regulations. The Oklahoma Air Pollution Council presented to the board the regulations and amendments, that imposed stiffer air pollution controls on industry and municipalities.

An amendment was made to provide a timetable of compliance for the prohibition of open burning by municipalities to bring all towns in the State in harmony with solid waste management regulations. Under the amendment, towns with greater than 10,000 population had to comply with the regulation by July 1, 1971. Towns with populations between 5,000 and 10,000 had to comply by July 1, 1972. Towns with populations between 3,000 and 5,000 must comply by July 1, 1973 and all others by July 1, 1974.

New regulations went into effect October 15, 1972, pertaining to the control of fugitive dust and requires that malfunctions of equipment be reported. The regulations also provide for standardization of test procedures and calculations, and control of the discharge of carbon monoxide, nitrogen oxides, and certain hydrocarbons.

Since the regulations and amendments became effective, the Air Pollution Council has granted variances to a number of companies to avoid severe difficulty and undue expense.

Officials of the Blackwell Zinc Co. announced that the 56-year-old smelting plant will be closed because the cost of additional equipment to meet environmental control regulations cannot be economically justified. The plant had been under attack by citizens who filed a $4.8 million suit charging that air pollution from the smelter was endangering health and property in the area. The smelter is scheduled for total shutdown in the last quarter of 1973.

The National Zinc Co. zinc smelter at Bartlesville was sold to National Zinc Co., Inc., a newly formed Oklahoma company backed mostly by local capital. This smelter also faces air pollution problems, but the recovery of sulfur as sulfuric acid greatly reduces the emission problem. The new company hopes to operate temporarily under variances to Oklahoma's air pollution regulations while a new smelter is constructed at Bartlesville.

All mining in the State now comes under Oklahoma's Mining Lands Reclamation Act, passed in 1968 and modified in 1971. The Act requires leveling and revegetation of all lands disturbed by mining. A bond of $350 to $650 is set, with administration of the regulations, by the Chief Mine Inspector, Oklahoma Department of Mines. Lands disturbed during fiscal 1972, according to the Chief Mine Inspector, totaled 1,638 acres, with strip mining for coal and copper accounting for 1,288 and 109 acres, respectively; acreage reclaimed during fiscal 1972 totaled 1,733 acres, with coal and copper accounting for 1,190 and 304 acres, respectively. Most coal operators are voluntarily handling topsoil separately and spreading it on the leveled spoil banks.

Transportation.—Cargo carried on the McClellan-Kerr Arkansas River Navigation System climbed to 5.7 million tons in 1972 compared with 3.9 million in 1971. Of the 5.7 million tons shipped in 1972, 2.2 million tons were inbound and outbound, and 3.5 million tons represented internal shipments.

For the Oklahoma portion of the McClellan-Kerr Arkansas River Navigation System, barge tonnage totaled 1.1 million tons, which was a 453% increase above that of 1971. Coal was the top commodity moved in 1972, with 461,839 tons, followed by iron and steel, with 192,500 tons. Other products were sand, fertilizer, chemicals, petroleum, paper, soybeans, and miscellaneous items.

Port Carl Albert, the third port constructed in Oklahoma on the navigation system, was dedicated in May 1972; it joins the Tulsa Port of Catoosa and the Port of Muskogee in serving eastern Oklahoma. The new port is only handling coal at the present time, with Garland Coal & Mining Co. having invested over $1.5 million in facilities that can load some 250,000 tons of coal annually. Port Carl Albert is located on the San Bois Creek Arm of Robert S. Ferr Reservoir in Haskell County.

Legislation and Government Programs.—The research program of the U.S. Bureau of Mines Bartlesville Energy Research Center focused on energy and environmental problems. The energy research program was primarily devoted to problems of extraction of petroleum and natural gas from underground reservoirs, natural gas storage, petroleum processing, petroleum and petroleum product quality and utilization, and thermodynamic properties and energy relationships of hydrocarbons and related compounds. Studies on the sources of air pollution from fuels combustion, particularly automotive, sources of water pollution, and liquid wastes disposal made up the environmental research program.

James H. Cobbs Engineering of Tulsa was awarded a contract by the U.S. Bureau of Mines to develop a state-of-the-art study of shaft-drilling techniques for the mining industry. The firm had previously developed a horizontal borehole packer for use in coalbeds for the Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The number of wells drilled in Oklahoma in 1972 in search for oil and gas increased slightly over the number drilled in 1971. The American Petroleum Institute (API) reported that 2,300 wells were drilled in 1972 compared with 2,255 wells drilled the previous year, an increase of 2%. Total footage drilled amounted to 12,297,180 feet. Average footage per well was 5,347 feet compared with 4,988 feet in 1971.

Of the 2,300 wells drilled in Oklahoma, 1,025 were completed to produce oil, 341 to produce gas, and 934 wells, 40.6% were dry holes. Exploratory drilling accounted for a total of 416 wells, which resulted in 37 oil wells, 55 gas wells, and 324 dry holes. Efforts to find new crude oil and gas deposits registered a success ratio of 22%.

Osage County accounted for the most wells drilled with 173 followed by Kingfisher and Carter Counties with 126 and 107, respectively.

The Anadarko Basin in the western part of the State was the center of interest in exploration for deep natural gas reserves. In Beckham County, two depth records were established. The Lone Star 1 Baden was drilled to the total depth of 30,050 feet, the deepest test in the world. The well was plugged back for gas production from a shallower depth. The Union Oil Co. of California 1 Bruner was completed from Devonian/Silurian Hunton as a gas well from open hole down to 24,548 feet, making it the world's deepest producing well. Ellis, Dewey, Roger Mills, and Custer Countries accounted for numerous gas discoveries and many development wells as activity extended southward deeper into the basin.

Carbon Black.—Continental Oil Co., the only producer of carbon black in Oklahoma, continued production from liquid hydrocarbons at its Ponca City plant in Kay County. Quantity and value of furnace carbon black increased in 1972 over that of 1971. Carbon black is used by the rubber industry in the manufacture of tires, shoe soles and heels, gaskets, conveyer belts, and other products.

Coal.—Bituminous coal production amounted to 2,624,000 short tons in 1972 compared with 2,234,000 tons in 1971. This was a 17% increase above that produced in 1971.

Coal is found in an area of about 15,000 square miles of the eastern part of the State. The workable coalbeds range in thickness from 1 to 8 feet, with most of the coals currently produced being 1 to 3 feet thick. Coal production was in six counties bordering or near the McClellan-Kerr Arkansas River Navigation System (Craig, Rogers, Muskogee, Pittsburg, Haskell, and Le Flore).

The U.S. Geological Survey estimates "available coal" in the State's reserve to be about 3.5 billion tons, with additional resources in unmapped and unexplored areas estimated at 30 billion tons. This places Oklahoma 17th in the Nation in coal reserves.

In January 1972, the Sierra Coal Corp. of Claremore loaded its first shipment of coal for delivery by barge to the Tennessee Valley Authority generating plant in Memphis, Tenn. The company has a $10.5 million contract to deliver 14 million tons of coal to this plant over a period of 5 years.

Western Continental, Inc., of Denver began shipping Nowata area coal out of the Tulsa Port of Catoosa to an electric company in Tampa, Fla. The company shipped more than 100,000 tons of coal on the McClellan-Kerr Arkansas River Navigation System before financial problems forced it to halt operations.

With Kerr-McGee Corp.'s Choctaw mine being placed on a standby basis, only one underground coal mine remains in operation in Oklahoma; the sole underground mine is Howe Coal Co.'s Bokoshe mine.

Lone Star Steel Co. acquired the properties and equipment of Evans Coal Co. at McCurtain, and coal is being shipped to Lone Star's steel plant in Dangerfield, Tex.

Ohio River Collieries began surface mining of coal in Haskell County late in 1972, with plans for establishing a mine capable of producing 300,000 tons annually.

The Oklahoma Geological Survey is continuing its study on the availability of high-volatile, high-sulfur bituminous coal to supply a proposed gasification plant with annual requirements of 10 million tons. The Survey has located a total of at least 200 million tons of this type coal suitable for gasification. Furthermore, in parts of the coalfield not presently mined, at least 200 million tons of additional coal reserves has been delineated by industry exploration.

Helium.—Helium extracted from natural gas at the Bureau of Mines, Keyes, Okla., plant amounted to 337 million cubic feet. High-purity (Grade A) helium output was 174 million cubic feet valued at $6.1 million compared with 1971 figures of 123 million cubic feet valued at $4.3 million. Crude helium output decreased to 163 million cubic feet valued at $2.0 million compared with the previous year of 270 million cubic feet valued at $3.2 million. All helium produced is measured at 14.7 PSIA at 70° F.

In April 1972, the Oklahoma Supreme Court handed down a decision concerning conveyance and reservation of mineral rights to helium in the case of Panhandle Cooperative Royalty Co. versus Cunningham. The court ruled essentially that the conveyance of rights to "oil and gas and other minerals" means oil and gas and other minerals produced with oil and gas; thus including helium but apparently excluding other minerals that are essentially solid, such as surface and near surface rock and ore deposits.

Natural Gas.—Oklahoma ranked third in the Nation in natural gas production, supplying 8.0% of domestic output. Marketed natural gas production was 1.8 trillion cubic feet, an increase of 7.3% above that of the previous year.

The Oklahoma Corporation Commission, after a number of hearings, in unprecedented action set a minimum price of 20 cents per Mcf on natural gas produced in the State. The commission stated that to sell gas below that price would be wasteful. Gas has been sold for under 5 cents per Mcf to over 30 cents per Mcf. A court test will decide if the Commission has such authority since gas sold in interstate, commerce and regulated by the Federal Power Commission (FPC), sells below the 20-cent level in most cases.

A natural gas storage field near Sayre in Beckham County, is to be expanded after the FPC approved a $20.7 million project planned by Natural Gas Pipeline Co. of America. The expansion is only part of a plan aimed at providing additional gas supplies to the system's markets in Chicago and the upper Midwest.

Due to extreme cold weather at the beginning and end of the year, a shortage of natural gas developed in certain areas of the State. Schools in several southwest communities were ordered closed and industrial and commercial use of natural gas was restricted. Alltime records for gas deliveries were established by major suppliers.

Cities Service Gas Co. of Oklahoma City announced they will no longer accept either directly or through distributors any new commercial and industrial customers whose gas needs are 3 million cubic feet or more per month, nor will they supply more than 3 million cubic feet per month to any of its present customers. Domestic uses, including new home connections, will have top priority in the communities served by the company.

According to the American Gas Association (AGA) at yearend, natural gas reserves for Oklahoma were estimated to be 14,492,030 million cubic feet compared with 15,712,818 million cubic feet in 1971.

Natural Gas Liquids.—Oklahoma ranked third nationwide in the production of natural gas liquids. There was a slight decline in quantity of approximately 30 thousand barrels from that of the previous year. At the beginning of the year, according to the annual Oil and Gas Journal survey, there were 85 gas-processing plants operating in the State. As reported by the AGA, proved natural gas liquid reserves at yearend were estimated to be 335,161,000 barrels, a decrease of 3,192,000 barrels from that of the previous year.

Skelly Oil Co. announced plans to build a natural gasoline plant about 20 miles southeast of Duncan in Stephens County. The new plant will extract natural gas liquids from a stream of 30 to 35 million cubic feet of gas per day.

Petroleum.—Crude oil production totaled 207,633,000 barrels, a decrease of 2.7% from 1971 production. Average wellhead value of crude oil in Oklahoma was $3.41 per barrel, compared with $3.40 in 1971. Nationwide, Oklahoma ranked fourth in production of crude petroleum and accounted for 6% of the U.S. total. Stephens County led the State's 62 oil-producing counties with a year's total of 26.0 million barrels followed by Carter and Garvin Counties, which produced 23.4 and 18.4 million barrels, respectively.

Production of crude oil was obtained from 73,745 wells compared with 75,572 wells in 1971. Average daily production from all producing wells amounted to 7.7 barrels per day which was the same as that of 1971. In 1972, the Oklahoma Corporation Commission ordered the continuation of the 200% depth-acreage formula allowable as indicated demand for Oklahoma crude oil remained strong at 210.4 million barrels. Stocks of crude oil originating in Oklahoma at the beginning of the year was 15.9 million barrels while at the end of the year, stocks had declined to 13.1 million barrels.

The API at yearend estimated Oklahoma's crude oil reserves to be 1,303,004,000 barrels, a decrease of 101,604,000 barrels below 1971 reserves.

According to the survey by the Interstate Oil Compact Commission and the National Stripper Well Association, as of January 1, 1972, Oklahoma had 54,712 stripper wells that averaged 4.05 barrels per day and could produce 81,117,312 barrels during the year. Stripper wells in Oklahoma account for approximately 39% of the State's total crude oil production.

Pipeline.—The FPC approved Arkansas-Louisiana Gas Co.'s plan to build a 300-mile, 30-inch pipeline from the Anadarko Basin across Oklahoma with connections to its distributing system in Arkansas. Approval was based on the need for gas supplies in the area served and the predominance of benefits of the project over its minimal environmental impact.

Explorer Pipeline Co. announced completion of its line from the Gulf Coast to Hammond, Ind. Eight companies combined to construct the line. The 1,300-mile common carrier has a present delivery capacity of 260,000 barrels daily of petroleum products. Products are moved through a 28-inch line from Lake Charles, La., to Tulsa and through a 24-inch line from Tulsa to Hammond, Ind., with the aid of 14 pumping stations. Product storage tank capacity totals 6,725,000 barrels.

Kaneb Pipe Line Co. announced plans to construct a 10-inch, 600-mile petroleum products pipeline from Tulsa to Denver, Colo., drawing from the Explorer Pipeline systems that links the gulf coast and Chicago area. The 10-inch line capacity will possibly be 80,000 barrels daily.

Oklahoma Natural Gas Co. completed the second phase of its 65.5-mile pipeline extending from McClain County to the south-central part of Blaine County. The first phase, 42.5 miles in length, constructed in 1970, linked the Norman-Oklahoma City area with the Anadarko Basin. The second phase was 23 miles long and extends the pipeline further into the gas-rich basin.

Refineries.—Oklahoma had a total of 12 refineries with a crude distillation capacity of 458,040 barrels daily at the first of the year, compared with 13 refineries with a capacity of 465,500 barrels daily in 1971.

On December 31, 1971, Kerr-McGee Corp. closed its refining facility at Cushing, which carried a capacity rating of 13,500 barrels daily. There were reductions in rated capacities by Okmulgee Refining Co., Inc., at Okmulgee and Sun Oil Co. at Duncan. Offsetting these declines were increases of 5,000 barrels daily each by Continental Oil Co. at Ponca City and Vickers Petroleum Corp. at Ardmore, plus an increase of 1,740 barrels daily by Midland Corp., Inc., at Cushing.

Kerr-McGee Corp. sold its crude oil refining facilities near Cushing, which has been idle since December 31, 1971, to Dewey Enterprises, Inc., of Dewey. The sale included real and personal property at the refinery with the exception of certain storage tanks, the land on which they are located, and equipment that the company will continue to utilize in its pipeline operations. Under terms of the sale, the buyer agreed to dismantle and remove the purchased facilities in a manner that will protect the area ecologically.

In October, Kerr-McGee Corp. stopped operating its naphtha plant in Cleveland. Rising costs and unsuccessful attempts to obtain satisfactory charge stock was the reason for the shutdown.

Texaco, Inc., released details for expanding its west Tulsa refinery to reduce lead content of its gasoline. The plant will add a 17,000-barrel-per-day hydrotreater, a 12,000-barrel-per-day catalytic reformer, a 270-gallon-per-minute amine regeneration unit, a 15-ton-per-day sulfur recovery unit, and a 100-gallon-per-minute sour water stripping unit.

Table 5.—Oklahoma: Estimated proved recoverable reserves of crude oil, natural gas liquids, and natural gas

Commodity	Proved reserves Dec. 31, 1971	Changes in proved reserves due to extensions, revisions, and new discoveries, in 1972	Proved reserves Dec. 31, 1972	Change from 1971 (percent)
Crude oil______thousand 42-gallon barrels__	1,404,608	96,813	1,303,004	−7.2
Natural gas liquids__________do____	338,353	38,608	335,161	−0.9
Natural gas__________million cubic feet__	15,712,818	544,497	14,492,030	−7.8

Source: American Petroleum Institute and American Gas Association.

Table 6.—Oklahoma: Crude oil production, indicated demand, and stocks, in 1972, by month

(Thousand 42-gallon barrels)

Month	Production	Indicated demand	End of month stocks originating within Oklahoma
January	17,696	18,664	14,905
February	18,017	17,863	15,059
March	17,464	16,530	15,993
April	16,921	17,440	15,474
May	18,073	17,630	15,917
June	17,112	18,271	14,758
July	17,967	19,486	13,239
August	16,708	17,414	12,533
September	17,108	18,037	11,604
October	17,165	17,409	11,360
November	16,480	16,002	11,838
December	16,922	15,616	13,144
Total:			
1972	207,633	210,362	XX
1971	213,313	215,029	XX

XX Not applicable.

Table 7.—Oklahoma: Oil and gas well drilling completions, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Alfalfa	25	4	7	1	1	--	38	240,905
Atoka	--	--	--	--	--	3	3	6,591
Beaver	20	13	15	1	1	3	53	359,171
Beckham	--	2	2	--	3	3	10	121,025
Blaine	7	33	11	1	3	6	61	576,003
Bryan	--	--	1	--	--	--	1	8,377
Caddo	21	--	10	2	1	23	57	348,867
Canadian	22	15	11	1	--	7	56	540,722
Carter	72	1	25	1	--	8	107	386,667
Cimarron	2	3	6	--	--	1	12	59,050

See footnotes at end of table.

Table 7.—Oklahoma: Oil and gas well drilling completions, by county—Continued

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Cleveland	2	--	5	--	--	10	17	122,679
Coal	1	--	1	1	--	5	8	41,809
Comanche	2	--	--	--	--	4	6	25,157
Cotton	2	--	6	--	--	2	10	19,496
Craig	--	--	--	--	1	--	1	311
Creek	46	--	20	--	--	5	71	170,279
Custer	--	1	2	--	5	1	9	142,150
Dewey	26	15	13	1	4	5	64	632,838
Ellis	3	10	10	--	3	6	32	340,944
Garfield	14	2	15	--	--	4	35	170,369
Garvin	12	--	19	3	--	23	57	337,402
Grady	30	10	19	2	1	13	75	792,275
Grant	11	2	3	--	--	2	18	86,914
Greer	--	2	--	--	--	4	6	11,065
Harmon	--	--	--	--	--	1	1	8,920
Harper	--	24	7	--	--	2	33	211,262
Haskell	--	2	3	--	--	--	5	34,947
Hughes	7	6	14	1	2	5	35	188,621
Jackson	1	--	--	--	--	5	6	34,074
Jefferson	2	--	1	1	--	8	12	33,989
Johnston	--	--	--	--	--	2	2	12,353
Kay	35	3	22	--	--	5	65	206,830
Kingfisher	78	17	26	1	2	2	126	1,047,643
Kiowa	24	1	16	--	--	--	41	34,004
Latimer	--	1	2	--	--	1	4	38,659
Le Flore	--	4	4	--	--	2	10	73,967
Lincoln	20	4	15	1	2	5	47	180,713
Logan	5	--	9	3	1	4	22	115,372
Love	4	--	7	--	--	6	17	117,313
McClain	1	1	10	1	1	11	25	217,287
McIntosh	--	6	3	--	--	--	9	25,486
Major	50	24	21	--	3	3	101	797,490
Marshall	1	--	1	--	1	1	4	27,832
Mayes	--	--	3	--	--	3	6	3,847
Murary	--	--	1	1	--	8	10	34,261
Muskogee	1	--	1	--	--	2	4	9,458
Noble	21	--	16	2	--	10	49	172,928
Nowata	45	--	10	1	--	11	67	42,539
Okfuskee	7	--	10	--	1	5	23	73,500
Oklahoma	6	--	3	1	--	1	11	69,025
Okmulgee	24	4	11	--	--	--	39	72,000
Osage	107	9	40	2	4	11	173	395,475
Pawnee	15	1	5	1	--	6	28	80,979
Payne	6	--	8	2	1	4	21	60,996
Pittsburg	--	15	11	--	--	6	32	187,569
Pontotoc	23	--	9	--	1	3	36	109,337
Pottawatomie	18	--	9	1	--	5	33	155,751
Pushmataha	--	--	--	--	--	1	1	365
Roger Mills	4	--	3	--	4	2	13	186,231
Rogers	12	--	6	--	--	--	18	8,518
Seminole	37	4	27	1	--	6	75	274,281
Stephens	48	1	12	1	3	7	72	297,851
Texas	12	5	19	1	1	3	41	253,668
Tillman	--	--	--	--	--	1	1	2,000
Tulsa	17	--	1	--	--	--	18	26,651
Wagoner	7	1	9	--	--	--	17	18,620
Washington	24	--	1	--	--	--	25	26,882
Washita	--	--	--	--	--	6	6	64,705
Woods	4	6	9	1	2	11	33	188,471
Woodward	4	34	24	--	3	11	76	582,945
Total	988	286	610	37	55	324	2,300	12,297,180

[1] Development wells as defined by American Petroleum Institute.
Source: American Petroleum Institute.

Table 8.—Oklahoma: Crude petroleum production, by field
(Thousand 42-gallon barrels)

Field	1971	1972	Cumulative to Dec. 31, 1972
Allen	2,920	2,880	121,755
Bowlegs	2,260	1,845	155,801
Burbank	5,240	4,715	496,617
Cement	2,870	2,890	186,274
Cushing	4,800	2,980	456,788
Edmond, West	780	730	158,806
Eola-Robberson	4,850	4,585	99,980
Fitts	1,420	1,600	146,074
Glenn Pool	2,480	2,090	305,432
Golden Trend	12,330	11,955	884,079
Healdton	4,600	5,595	279,487
Hewitt	5,660	5,590	205,378
Oklahoma City	1,750	1,850	730,008
Seminole Greater	1,640	1,345	197,320
Sho-Vel-Tum	36,500	33,800	934,886
Sooner Trend	15,240	14,390	164,854
St. Louis	1,350	1,290	218,818
Other fields	107,673	108,503	NA
Total	213,313	207,633	--

Source: Oil and Gas Journal data adjusted to Bureau of Mines total.

NONMETALS

Cement.—Portland and masonry cement were manufactured at three plants in Oklahoma in 1972. Shipments of portland cement increased 26%, and masonry cement shipments increased 22% above that of the previous year. Average mill value of portland cement was $19.06 per short ton, and average value of masonry cement was $24.80 per short ton. Portland and masonry cement consumed in Oklahoma totaled nearly 1.4 million short tons and 64 thousand short tons, respectively. Raw materials used in making portland cement included limestone, clay and shale, sand, gypsum, and iron-bearing materials.

Construction was started on a kiln modification project by Oklahoma City Cement Co., Div. OKC Corp., at its Pryor, Okla., plant that will increase annual capacity by 75,000 tons to a total of 451,000 tons when completed in late 1973.

Clays and Shale.—Output of common clay and shale increased both in quantity and value above that of 1971 by 11%. During 1972, there were 15 companies with operations in 13 counties. Bentonite, an absorptive and colloidal clay, was mined in Dewey County.

Upon completion of its plant west of Oklahoma City, Oklahoma Brick Corp. will be the first and only fully automated clay brick manufacturing facility west of the Mississippi River. The red clay shale is fed by conveyer belt into a mixer, extruded as a continuously moving slab, and sliced automatically into uniform brick.

Acme Brick Co. announced plans to increase the capacity of its Tulsa plant from 16 million bricks to 40 million bricks per year. Eleven new kilns of the newest steel-jacketed, beehive type are included in the new plant.

Gypsum.—Production of gypsum, a major mineral commodity for the construction industry, continues to increase in quantity and value. Gypsum was mined from open pits in Blaine, Caddo, Canadian, Comanche, Jackson, and Washita Counties in western Oklahoma. Quantity and value increased 17% and 27%, respectively, in 1972 above that of 1971. Large reserves of high-purity gypsum of Permian age crop out and are at shallow depth in three regions of western Oklahoma. The northwest and southwest regions contain gypsum beds in the Blaine Formation that are 10 to 30 feet thick and are generally 95% to 98% pure. The west-central region contains the Cloud Chief Gypsum, which is 20 to 90 feet thick and has a purity of 92% to 97%. Reserves, estimated at 48 billion short tons by the Oklahoma Geological Survey, are almost equally divided among the three regions. Eight companies in the State operated 11 mines and processed the stone for wallboard, for plaster, as a retarder in portland cement, and as a soil conditioner.

Lime.—St. Clair Lime Co., the only producer of chemical-grade lime in the State, added a new rotary kiln at their Marble City facility in Sequoyah County. The productive capacity of the new kiln is 450 tons per day, and the capacity of an older kiln, which is still operated, is 220 tons per day. The company's vertical kilns and one rotary kiln in nearby Sallisaw were shutdown. St. Clair Lime uses stone that is 98.8% to 99.3% calcium carbonate from the Quarry Mountain Formation of Silurian age.

Pumice.—Pumice was produced in Beaver County by Axtell Mining Corp. Quantity and value was approximately the same as that of 1971.

Salt.—Permian rock salt underlies most of western Oklahoma at depths of 30 to 3,000 feet. Individual salt beds 5 to 25 feet thick are interbedded with thinner layers of shale and anhydrite. Five large salt plains are fed by natural brine springs emitting 150 to 3,000 tons of salt per day. Reserves, estimated at 20 trillion tons by the Oklahoma Geological Survey, are virtually untapped. Production of salt in the State was from three solar evaporation plants located in Harmon and Woods Counties. It is used mainly for stock-feed, recharging water softeners, and deicing roads. Production quantity and value decreased below that of 1971.

Sand and Gravel.—Production of sand and gravel in 1972 totaled 7.9 million short tons, valued at $11.1 million. (The data for 1972 are not directly comparable with those of previous years, because revisions in the Bureau of Mines mailing lists resulted in greatly increased industry coverage.) Production of high-purity silica sand was reported by Pennsylvania Glass Sand Corp. of Okla. and Midcontinent Glass Sand Co., in Johnston and Pontotoc Counties; plantrun (washed) glass sand is more than 99.8% silica.

Table 9.—Oklahoma: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,158	r 2,389	3,078	3,572
Fill	271	106	1,186	599
Paving	1,508	1,813	1,935	2,094
Other uses [1]	757	2,685	848	3,568
Total [2]	4,694	6,993	7,048	9,832
Gravel:				
Building	62	93	120	188
Paving	102	279	120	130
Miscellaneous	6	9	W	W
Other uses [3]	--	--	19	31
Total [2]	171	382	258	349
Government-and-contractor operations:				
Sand:				
Building	408	516	34	478
Fill	9	9	299	401
Paving	267	143	220	46
Other uses	7	1	--	--
Total [2]	690	669	553	925
Gravel:				
Building	115	201	4	22
Fill	--	--	7	7
Paving	44	15	31	4
Total	159	216	42	33
Total sand and gravel [2]	5,713	8,259	[4] 7,901	[4] 11,138

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes ground and unground, railroad ballast (1971), and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes fill and other gravel.

[4] Data not directly comparable with previous years because of increased industry coverage.

Stone.—Production of stone in 1972 was about the same in quantity but decreased in value from that of 1971. Material marketed as stone included limestone, dolomite, granite, sandstone, and chat (crushed chert, limestone, and dolomite rejected from lead-zinc mining and milling operations that once flourished in Ottawa County).

Sulfur.—Pioneer Gas Producing Co. recovered 1,102 long tons of sulfur from sour natural gas at their plant in Marshall County.

Tripoli.—Output of tripoli, which is used in abrasives, buffing compounds, oil well drilling mud, and in foundry processes, increased 29% in both quantity and value above that of 1971. The Carborundum Co. is the largest producer in Ottawa County.

METALS

Copper.—Copper output in 1972 decreased slightly in quantity and value below that of the previous year, with all production coming from one mine. Eagle-Picher Industries, Inc., continued strip mining 6 to 10 inches of copper-shale ore at their Creta mine in Jackson County; the mine was opened in September 1965. A second copper-shale property, near Mangum in Greer County, is still being developed by Lobaris Copper Co.

Silver.—Small amounts of silver are recovered from smelting copper concentrates produced by Eagle-Picher Industries, Inc., in Jackson County. The value of 1972 recovery increased 7.5% above the 1971 value.

Table 10.—Oklahoma: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension:				
Limestone	2	29	2	28
Granite	4	417	3	867
Total	6	446	5	895
Crushed and broken:				
Limestone [1]	17,961	25,075	18,035	24,537
Other stone [2]	1,482	1,604	1,407	1,641
Total	19,448	26,679	19,442	26,178
Grand total [3]	19,449	27,125	19,448	26,574

[1] Data include dolomite.

[2] Data include sandstone, quartz, quartzite (1971), and traprock (1972).

[3] Data may not add to totals shown because of independent rounding.

Table 11.—Principal producers

Commodity and company	Address	Type of activity	County
Carbon Black: Continental Carbon Co.	P.O. Box 22085 Houston, Texas 77027	Furnace	Kay.
Cement:			
Dewey Rocky Mountain Cement Co.[1]	1210 Fourth Nat'l. Bank Tulsa, Okla. 74119	Quarry and plant	Rogers.
Ideal Cement Co., Div. Ideal Basic Industries, Inc.[1]	420 Ideal Cement Bldg. Denver, Colo. 80202	do	Pontotoc.
Oklahoma Cement Co. Div. OKC Corp.[1]	P.O. Box 68 Pryor, Okla. 74361	do	Mayes.
Clays:			
Acme Brick Co	P.O. Box 425 Fort Worth, Tex. 76101	Mine and plant	Custer, Oklahoma, Tulsa.
Chandler Materials Co	Box 627 Tulsa, Okla. 74101	do	Rogers, Oklahoma.
Filtrol Corp	3250 East Washington Los Angeles, Calif. 90023	do	Dewey.
Mangum Brick Co	Box 296 Mangum, Okla. 73554	do	Greer.
Oklahoma Brick Corp	Box 87 Union City, Okla. 73090	do	Canadian.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays—Continued			
Sapulpa Brick & Tile Corp.	Box 460 Sapulpa, Okla. 74066	Mine and plant	Creek.
Superior Clay Products, Inc.	Box 1501 Ada, Okla. 74820	-----do----------	Pontotoc.
United Clay Pipe Co	Box 552 Seminole, Okla. 74868	-----do----------	Seminole.
Wewoka Brick and Tile Co.	415 West 10th Street Wewoka, Okla. 74884	-----do----------	Do.
Coal:			
Bills Coal Co., Inc	Route 1 Welch, Okla. 74369	Strip mine	Craig.
Evans Coal Co	Box 126 McCurtain, Okla. 74944	Strip and auger mine.	Haskell.
Garland Coal & Mining Co.	Box 186 Fort Smith, Ark. 72901	Strip mine	Do.
Howe Coal Co	Box 99 Heavener, Okla. 74937	Underground mine	Le Flore.
Kerr-McGee Corp	Kerr-McGee Bldg. Oklahoma City, Okla. 73102	-----do----------	Haskell.
McNabb Coal Co	Box C Catoosa, Okla. 74105	Strip mine	Rogers.
Peabody Coal Co	301 North Memorial Drive St. Louis, Mo. 63102	-----do----------	Do.
Copper and silver: Eagle-Picher Industries, Inc.	P.O. Box 910 Miami, Okla. 74354	-----do----------	Jackson.
Gypsum:			
Republic Gypsum Co	1100 Mercantile Bank Bldg. Dallas, Tex. 75201	Quarry and plant	Do.
United States Gypsum Co	101 South Wacker Drive Chicago, Ill. 60606	-----do----------	Blaine.
Universal Atlas Cement, Div. of United States Steel Corp.	600 Grant St., Box 2969 Pittsburgh, Pa. 15230	Quarry	Do.
Lime: St. Clair Lime Co	Box 894 Oklahoma City, Okla. 73101	Plant and quarry	Sequoyah.
Salt:			
Blackmon Salt Co	Freedom, Okla. 73842	Solar evaporation	Woods.
Western Salt Co	Route 2 Erick, Okla. 73645	-----do----------	Harmon.
Sand and gravel:			
Bagby-Harris Sand Co	P.O. Box 926 Jenks, Okla. 74037	Dredge	Tulsa.
Joe Brown Sand & Gravel Co.	Box 102 Sulphur, Okla. 73086	Stationary	Murray.
The Dolese Co	13 Northwest 13th St. Oklahoma City, Okla. 73103	-----do----------	Canadian, McClain, Kingfisher, Logan, Garfield.
McMichael Concrete Co	Box 9486 Tulsa, Okla. 74107	Dredge	Tulsa.
Midcontinent Glass Sand Co.	Roff, Okla. 74865	Stationary	Pontotoc.
Mohawk Rock & Sand Co	1840 East 16th St. Tulsa, Okla. 74120	Dredge	Tulsa.
Pennsylvania Glass Sand Corp. of Okla.	Berkeley Springs, W. Va. 25411	Stationary	Johnston.
Sand Products, Inc	3405 East Reno Oklahoma City, Okla. 73117	Stationary and dredge.	Oklahoma.
Tulsa Sand Co	Box 1954 Tulsa, Okla. 74101	Stationary	Pawnee, Tulsa.
Yahola Sand & Gravel Co	323 Merchants Bank Bldg. Ft. Smith, Ark. 72901	-----do----------	Muskogee.
Stone:			
Anchor Stone Co	Box 1630 Tulsa, Okla. 74106	Quarry	Tulsa.
Arkhola Sand & Gravel Co.	323 Merchants Bank Bldg. Ft. Smith, Ark. 72901	-----do----------	Cherokee.
Dolese Brothers Co	13 Northwest 13th St. Oklahoma City, Okla. 73103	-----do----------	Caddo, Carter, Coal, Comanche, Kiowa, Murray, Pittsburg, Seminole.
Eagle-Picher Industries, Inc.	P.O. Box 910 Miami, Okla. 74354	-----do----------	Ottawa.
The Quapaw Co	Box 72 Drumright, Okla. 74030	-----do----------	Creek, Okmulgee.
Sooner Rock and Sand Co	2835 Northeast 23d Oklahoma City, Okla. 73111	-----do----------	Murray.
Standard Industries, Inc	P.O. Box 15670 Admiral Station Tulsa, Okla. 74115	-----do----------	Osage, Tulsa.
Trinity Concrete Products Co.	Box 1290 Dallas, Tex. 75221	-----do----------	Atoka.

See footnotes at end of table.

Table 11.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Tulsa Rock Co	Box 15691 Admiral Station Tulsa, Okla. 74115	Quarry	Tulsa.
Tripoli: The Carborundum Co., American Tripoli Div.	Seneca, Mo. 64865	Open pit	Ottawa.
Volcanic ash: Axtell Mining Corp.	Laverne, Okla. 73848	do	Beaver.
Helium: U.S. Bureau of Mines	P.O. Box 46 Keyes, Okla. 73947	Helium processing	Cimarron.
Smelters:			
American Metal Climax, Inc., Blackwell Zinc Co.	Blackwell, Okla. 74631	Zinc	Kay.
Kaiser Chemicals, Inc	Tulsa, Okla. 74100	Magnesium	Tulsa.
National Zinc. Co	Bartlesville, Okla. 74003	Zinc	Washington.
Petroleum refineries:			
Allied Materials Corp	Stroud, Okla. 74079	Refinery	Lincoln.
Apco Oil Corp	Cyril, Okla. 73029	do	Caddo.
Bell Oil and Gas Co	Ardmore, Okla. 73401	do	Carter.
Champlin Petroleum Co	Enid, Okla. 73701	do	Garfield.
Continental Oil Co	Ponca City, Okla. 74601	do	Kay.
Kerr-McGee Corp	Wynnewood, Okla. 73098	do	Garvin.
Midland Cooperatives, Inc	Cushing, Okla. 74023	do	Payne.
Okmulgee Refining Co	Okmulgee, Okla. 74447	do	Okmulgee.
Sun Oil Co., DX Div	Duncan, Okla. 73533	do	Stephens.
Do	Tulsa, Okla. 74100	do	Tulsa.
Texaco, Inc	do	do	Do.
Tonkawa Refining Co	Arnett, Okla. 73832	do	Ellis.
Natural gas liquids:			
Champlin Petroleum Co	Fort Worth, Tex. 76100	Natural gas liquids processing.	Garfield, Oklahoma.
Cities Service Oil Co	Bartlesville, Okla. 74003	do	Garfield, Kay, Oklahoma, Texas.
Humble Oil & Refining Co.	Tulsa, Okla. 74100	do	Dewey, Kingfisher.
Mobil Oil Corp	Taloga, Okla. 73667	do	Dewey, Grady, Stephens, Texas, Woodward.
Phillips Petroleum Co	Bartlesville, Okla. 74003	do	Garvin, Oklahoma.
Skelly Oil Co	Oklahoma City, Okla. 73100	do	Beckham, Carter, Dewey.
Signal Oil & Gas Co	Ardmore, Okla. 73401	do	Carter.
Shell Oil Co	Tulsa, Okla. 74100	do	Stephens.
Sun Oil Co	do	do	Cleveland, Grant, Harper, Kay, Lincoln, McClain.
Texaco, Inc	do	do	Beaver, Caddo, Lincoln, Love.
Union Texas Petroleum, Div. of Allied Chemical Corp.	do	do	Major.
Warren Petroleum Corp	do	do	Beaver, Garvin, Grady, Stephens.

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[1] Also crushed and broken limestone, and clays.

The Mineral Industry of Oregon

By John D. Corrick[1]

The value of Oregon's mineral production decreased in 1972 to $76.5 million, a 2% decline from the 1971 value of $78.0 million. Nonmetals accounted for 90% of the total mineral production value. Losses in production value for clays, nickel, and stone more than offset gains in the production value for gem stones, lime, sand and gravel, and cement.

Oregon remained the only producer of primary nickel in the United States in 1972. Nickel mine production decreased 1% in 1972 compared with that of 1971. Activity related to gold production increased in 1972. Cornucopia Minerals, Inc. of Denver, Colo., began mining a gold placer deposit on Pine Creek about 45 miles northwest of Baker, Oreg., in 1972. Increased demand for aluminum at yearend resulted in Reynolds Metals Co. reopening its Troutdale aluminum reduction plant which had been closed for 1 year.

Construction of Portland General Electric Co.'s Trojan nuclear powerplant near Rainier, Oreg., continued to progress in 1972. The plant received a 353-ton nuclear reactor vessel and two of four 350-ton generators during the year.

Concern for Oregon's environment became more evident in 1972 when the Department of Environmental Quality (DEQ) began imposing pollution standards on industry, including noise levels on exploration in wilderness areas. Exploratory drilling for oil and gas on Federal lands was delayed pending preparation of environmental impact statements. No Federal leases for geothermal drilling were granted in 1972 because an environmental impact statement and Federal regulations governing the leasing of land, drilling and operation of geothermal wells had not been completed.

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[1] Physical scientist, Division of Ferrous Metals—Mineral Supply.

Table 1.—Mineral production in Oregon[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays .... thousand short tons..	157	$255	151	$238
Copper .... short tons..	3	3	W	W
Diatomite .... do....	70	1	W	W
Emery .... do....	1	W	--	--
Gem stones	NA	755	NA	793
Gold .... troy ounces..	244	10	W	W
Lime .... thousand short tons..	106	1,989	96	2,129
Mercury .... 76-pound flasks..	W	W	--	--
Nickel .... short tons..	17,036	W	16,864	W
Pumice and volcanic cinder .... thousand short tons..	r 948	r 1,389	W	W
Sand and gravel .... do....	20,230	28,707	[2] 24,489	[2] 34,981
Silver .... thousand troy ounces..	4	6	2	4
Stone .... thousand short tons..	13,794	26,708	10,915	18,380
Value of items that cannot be disclosed:				
Cement, talc, tungsten and values indicated by symbol W	XX	18,212	XX	19,991
Total	XX	r 78,035	XX	76,516
Total 1967 constant dollars	XX	66,351	XX	p 63,654

p Preliminary. r Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Data not directly comparable with previous years because of increased industry coverage.

Table 2.—Value of mineral production in Oregon, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Baker	$8,249	$6,814	Cement, sand and gravel, stone, pumice, clays, silver, copper, tungsten.
Benton	434	1,024	Sand and gravel, stone, clays.
Clackamas	12,495	13,879	Cement, sand and gravel, stone, clays.
Clatsop	W	W	Stone, sand and gravel.
Columbia	W	2,109	Sand and gravel, stone.
Coos	634	574	Stone, sand and gravel, copper, gold, silver.
Crook	358	W	Sand and gravel, clays.
Curry	W	W	Stone, sand and gravel.
Deschutes	852	1,500	Pumice, sand and gravel, stone.
Douglas	10,294	10,743	Nickel, sand and gravel, stone.
Gilliam	W	W	Sand and gravel, stone.
Grant	1,011	W	Stone, sand and gravel.
Harney	W	451	Stone.
Hood River	W	W	Stone, sand and gravel.
Jackson	1,700	1,044	Sand and gravel, stone.
Jefferson	W	W	Stone, sand and gravel.
Josephine	2,076	954	Sand and gravel, stone, talc, copper, silver.
Klamath	2,228	1,649	Stone, sand and gravel, pumice, clays.
Lake	r 806	949	Stone, pumice, sand and gravel.
Lane	5,288	3,647	Sand and gravel, stone, clays.
Lincoln	1,033	W	Sand and gravel, stone.
Linn	833	1,222	Do.
Malheur	1,360	1,470	Stone, lime, sand and gravel.
Marion	1,120	2,290	Sand and gravel, clays, stone.
Morrow	W	48	Stone.
Multnomah	7,940	8,247	Sand and gravel, lime, stone, clays.
Polk	422	W	Sand and gravel, stone.
Sherman	46	1,249	Stone, sand and gravel.
Tillamook	308	699	Sand and gravel, stone.
Umatilla	2,008	W	Stone, sand and gravel.
Union	1,676	2,115	Do.
Wallowa	474	111	Sand and gravel.
Wasco	W	W	Stone, sand and gravel.
Washington	2,131	2,749	Stone, sand and gravel, clays.
Wheeler	60	W	Sand and gravel, stone.
Yamhill	456	538	Sand and gravel, stone, clays.
Undistributed [1]	11,746	10,947	
Total [2]	r 78,035	76,516	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

Employment, Trade, and Markets.—According to figures published by the Oregon Employment Division, Department of Human Resources, Oregon's work force reached the million mark for the first time in June 1972. Total employment in June was 960,800. The 1972 civilian labor force increased 3% over the 1971 force. Seasonally adjusted unemployment at yearend 1972 was 6.2% of the labor force compared with 6.0% at yearend 1971. Principal industries showing increased unemployment in 1972 were lumber, concrete products, and contract construction. The mining industry showed an increase in employment of 14% between December 1971 and December 1972. During 1972, employment in the primary metals manufacturing sector rose 18% and in the fabricated metals sector, 6%. Much of the hiring in the primary metals industry resulted from the aluminum industry anticipating an expanding market in 1973. The primary metals industry set a record in November for new hires with 3.1 new hires per 100 employees. Quits, which partially reflect worker assessment of job opportunities, reached 3.1 (seasonally adjusted) in 1972 and was the highest quit rate since June 1969 (3.5). Oregon's wage and salary employment index [2] averaged 119.5 in December 1972 compared with 114.9 in December 1971. This approximated the Nation's pattern which reached 114.3 in December 1972 compared with 109.9 a year earlier.

Oregon's excellent financial health was confirmed by key 1972 economic statistics. These data, with the increase over that of 1971 shown in parentheses were as follows: Personal income, $9.4 billion (10.7%); gross State product, $11.1 billion (11.8%); retail sales, $4.8 billion (11.5%); average total employment, 932,300 (4.8%); average manufacturing employment, 178,500 (4.4%); and residential housing permits value, $447.8 million (12.3%). The net result was a rising weekly earning index through November 1972 when it peaked at 142.0. Hourly earnings in manufacturing rose 6.2% in 1972; however, average weekly earnings showed a decrease from $164.67 in December 1971 to $163.32 in December 1972. The December weekly earnings were down 6% from November's high of $174.64, reflecting a sharp decrease in weekly hours worked. A severe snowstorm plus subzero weather throughout the State in December were the principal reasons for the decrease. Average hourly earnings in the primary metals and fabricated metals industries increased during the year. The average hourly rate for primary metal workers increased from $4.67 in 1971 to $4.99 in 1972, and for fabricated metal workers from $4.32 to $4.63. Both industries exceeded the yearend average hourly earnings for total manufacturing of $4.45.

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[2] This index and all others used in the text assume a base of 1967=100.

Government Programs.—The Oregon De-

Table 3.—Indicators of Oregon business activity.

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force……thousands..	948.1	981.7	+3.5
Unemployment……do....	59.6	63.1	+5.9
Employment:			
Construction……do....	29.7	30.2	+1.7
Lumber and wood products……do....	69.1	71.5	+3.5
Food products……do....	21.3	19.6	−8.0
Mining……do....	1.2	1.6	+33.3
Manufacturing……do....	170.9	173.5	+4.4
Personal income:			
Total……millions..	$8,470.0	$9,374.0	+10.7
Per capita……	$3,959.0	$4,296.0	+8.5
Construction activity:			
Number of authorized private and public residential units……	26,290.0	28,286.0	+7.6
Value of nonresidential construction……millions..	$149.2	$178.7	+19.8
Value of highway contracts awarded……do....	$112.0	[e] $96.0	−14.3
Cement shipments to and within Oregon……thousand short tons..	704.0	806.0	+14.5
Cash receipts from farm marketings……millions..	$595.5	$668.8	+12.3
Mineral production value……do....	[r] $78.0	$76.5	−1.9

[e] Estimate. [p] Preliminary. [r] Revised.

Sources: Oregon's Labor Force Trends; Survey of Current Business; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries: Fatal	Number of injuries: Nonfatal	Injury rates per million man-hours: Frequency	Injury rates per million man-hours: Severity
1971:								
Coal……	3	160	(1)	4	--	--	--	NA
Metal……	121	169	20	164	--	1	6.10	1,831
Nonmetal……	81	171	14	111	--	1	9.01	162
Sand and gravel……	1,360	204	277	2,321	1	59	25.85	3,386
Stone……	1,396	228	319	2,605	--	84	32.24	618
Total[2]……	2,961	213	631	5,204	1	145	28.05	1,878
1972:[3]								
Coal……	NA	NA	NA	NA	NA	NA	NA	NA
Metal……	105	207	21	170	--	2	11.76	406
Nonmetal……	45	157	7	59	--	1	16.81	286
Sand and gravel……	660	227	150	1,293	3	66	53.34	14,503
Stone……	585	212	124	991	1	57	58.52	6,731
Total……	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Less than 500.

[2] Data may not add to totals shown because of independent rounding.

[3] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

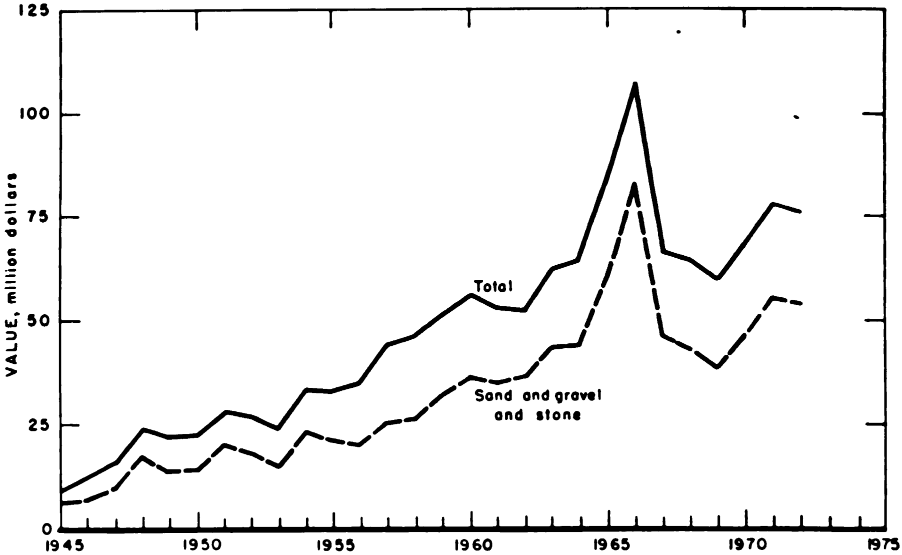

Figure 1.—Value of sand and gravel and stone, and total value of mineral production in Oregon.

partment of Geology and Mineral Industries received a $76,000 grant from the Federal Bureau of Mines to conduct a research program for locating potential geothermal reservoirs within the State. The State was to contribute $25,000 to the study.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Oregon's only cement producer, Oregon Portland Cement Co., operated its Lime, Baker County, and Lake Oswego, Clackamas County, cement plants at slightly higher rates than in 1971. Output of portland cement increased for the third consecutive year and exceeded that of 1971 by 5%.

Combined shipments from three plants located in Oregon and Nevada totaled 854,209 tons of finished portland cement in 1972 compared with 846,000 tons in 1971. Average value of portland cement shipped from these plants in 1972 decreased from that of 1971.

Clays.—Production of clay and shale decreased 4% in quantity and 7% in value compared with that of 1971. Seventeen mines were responsible for the 150,736 tons of clay and shale produced in 1972. Oregon's 1972 clay and shale production came from 10 counties with the major portion coming from Washington, Baker, and Multnomah Counties. Consumption of clay and shale occurred principally in the manufacture of cement and lightweight aggregate and face bricks.

Lime.—Lime production in 1972 amounted to 95,673 tons valued at $2,128,547, a decrease of about 10% in quantity but an increase of 7% in value compared with that of 1971. The lime was produced by Ash Grove Cement Co., Amalgamated Sugar Co., and Pacific Carbide & Alloys Co. in Multnomah and Malheur Counties. Principal uses were in sugar refining, pulp and paper, and calcium carbide manufacturing. The major portion of lime produced was consumed in Oregon and Washington.

Pumice and Volcanic Cinder.—Output of pumice and volcanic cinder decreased in 1972 compared with that of 1971. Principal use for the material was in road construction. Other uses were in concrete aggregates, concrete admixtures, and other uses. Production occurred in Deschutes, Klamath, Lake, and Baker Counties.

The controversy over validity of claims to pumice deposits at Rock Mesa in the Three Sisters Wilderness area of Oregon continued throughout the year. Forest Service supervisors of the Willamette and Deschutes National Forests indicated they would request further studies to determine the validity of the claims.

Sand and Gravel.—Output of sand and gravel increased to 24.5 million tons in 1972, an increase of 21% over that of 1971. Production for preceding years was 18.3 million tons in 1968, 15.7 million tons in 1969, 17.5 million tons in 1970, and 20.2 million tons in 1971. The average price per ton increased from $1.42 in 1971 to $1.43 in 1972.

Production of sand and gravel was reported in all but Harney and Morrow Counties in 1972. A total of 150 mines and pits were in operation during the year. Production came principally from Multnomah, Clackamas, and Lane Counties.

Corvallis Sand and Gravel Co. continued its court fight for ownership of lands recently awarded the State by Oregon courts. A ruling by the Circuit Court in 1972 awarded Corvallis a small part of riverbed land that had been under dispute for several years. However, since the State retained the major portion of land, Corvallis Sand & Gravel Co. appealed the decision. Meanwhile, the State permitted Corvallis to bid for the right to dredge the lands won by the State.

Clackamas County Commissioners unanimously denied a request for expanded gravel mining from the banks of the Clackamas River on August 23, 1972. The Commissioners stated a preference for future gravel mining to be on land well removed from rivers and streams. A similar situation arose in West Salem, Polk County, when an application was filed for

Table 5.—Oregon: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,960	2,594	3,030	4,514
Fill	727	569	575	1,429
Paving	535	738	1,914	3,307
Railroad ballast	W	W	8	45
Other uses [1]	116	165	263	281
Total [2]	3,338	4,067	5,785	9,576
Gravel:				
Building	4,802	6,716	5,582	8,125
Fill	969	896	1,572	1,589
Paving	7,113	11,523	7,173	10,396
Railroad ballast	W	W	156	230
Miscellaneous	246	195	377	419
Other uses	409	581	92	127
Total [2]	13,537	19,911	14,951	20,885
Government-and-contractor operations:				
Sand:				
Building	28	84	--	--
Fill	--	--	W	W
Paving	77	77	W	W
Total [2]	105	161	[3] 12	[3] 15
Gravel:				
Building	148	224	W	W
Fill	100	77	246	217
Paving	3,001	4,268	3,433	4,199
Other uses	--	--	62	87
Total [2]	3,250	4,568	3,741	4,504
Total sand and gravel [2]	20,230	28,707	24,489	34,981

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes engine (1971) and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes fill and paving.

a zoning change to permit sand and gravel removal from the Willamette River. Salem residents voiced strong opposition to the sand and gravel operation. It appeared that these decisions and hearings were but a prelude to subsequent hearings opposing gravel removal operations situated near suburban areas. Coincidental to the Salem residents' opposition, the State Geologist warned that without proper planning, the Willamette Valley would run out of gravel by the end of the century.

Stone.—Production of stone decreased 21% in tonnage and 31% in value in 1972 compared with that of 1971. Major uses of stone were in dense graded road base stone, unspecified aggregate and roadstone, other uses, and surface treatment aggregate. Those categories that showed the greatest decrease in tonnage sold or used in 1972 from that of 1971 were macadam aggregate (87%), and unspecified aggregate and roadstone (33%). Uses that showed a significant increase in tonnage sold or used in 1972 were other uses (120%), and riprap and jetty stone (95%).

Table 6.—Oregon: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone total	W	W	1	30
Crushed and broken:				
Bituminous aggregate	1,185	2,062	1,273	1,955
Concrete aggregate	1,658	5,956	W	W
Dense graded road base stone	4,529	7,116	3,328	4,953
Macadam aggregate	439	699	57	83
Surface treatment aggregate	1,402	2,167	1,350	1,891
Unspecified aggregate and roadstone	2,992	5,954	2,015	3,566
Fill	94	72	120	112
Railroad ballast	375	518	432	596
Riprap and jetty stone	500	1,045	973	1,478
Other uses [1]	621	1,125	1,367	3,717
Crushed total [2]	13,794	26,708	10,915	18,350
Grand total [2]	13,794	26,708	10,915	18,380

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes stone used in cement and lime (1972) manufacture, agricultural purposes, building products, drain fields, flux and refractory (1972), glass and unspecified uses. The 1971 data also include stone used in paper manufacture, sugar refining, ferrosilicon, and abrasives.

[2] Data may not add to totals shown because of independent rounding.

R&R Cultured Marble Co. began operations in the McMinnville area of Oregon in 1972. The company manufactured a product made from finely ground natural granite and bonded with a stabilized polyester resin. The cultured marble was used in the manufacture of sinks, table tops, and tub-shower walls for residential and commercial use. The company initially planned to market its products in Oregon.

Talc and Soapstone.—A small quantity of soapstone was mined in Josephine County for use in sculpturing by art classes at educational institutions. In addition, Stauffer Chemical Co. in Multnomah County purchased out-of-State talc for grinding purposes. Most of Stauffer's ground talc was used in insecticides.

METALS

Aluminum.—Aluminum production in Oregon returned to normal late in 1972 when Reynolds Metals Co. reopened potlines at its Troutdale plant. The potlines were shutdown during most of 1972. Aluminum production increased 45% in 1972 compared with that of 1971. Planned reopening of the fourth potline in early 1973 would bring production capacity up to 105,000 tons per year, out of a total capacity of 130,000 tons.

The chairman of American Metal Climax, Inc. (AMAX) publicly admitted that the costs of meeting environmental demands in Oregon had resulted in a decision to delay construction of the Warrenton aluminum reduction plant. Environmentalists expressed strong opposition to the location of the plant, claiming plant effluents would damage the Columbia River estuary. Company officials recognized that environmental considerations in Oregon have a cost factor attached to them, and that the company must consider these environmental cost factors when evaluating new facilities.

The Oregon Supreme Court in 1972 ruled that Harvey Aluminum Inc. was responsible for fluoride damage to peaches and apricots grown in the Dalles area of Oregon. Harvey operated an aluminum reduction plant in The Dalles. The court returned the case for retrial on the subject of how much money the company must pay for damages. Wasco County Circuit Court originally awarded the plaintiff $500,000.

Gold and Silver.—Activities related to gold production in Oregon increased in 1972, compared with that of 1971. Gold was produced from five placer and four lode mines during 1972. The value of silver recovered from ores in 1972 amounted to $3,795 and totaled 2,252 ounces. The average annual price was $58.60 per ounce of gold and $1.685 per ounce for silver.

A Denver, Colo., firm, Cornucopia Minerals, Inc., began mining a gold placer deposit on Pine Creek about 45 miles northwest of Baker, Oreg. Recovered nuggets averaged 84% gold and 16% silver and were used principally in jewelry. The nuggets were marketed in Denver, Seattle, San Francisco, and Lewiston, Idaho. The placer operation was the first to comply with the State's Mined-Land Reclamation Act. The land was reclaimed behind the operation and made suitable for recreational home sites.

Young people setting up residences in the National Forests and claiming to be gold miners created numerous problems in southern Oregon in 1972. Many filed mining claims, which the Forest Service felt were excuses to live on the land. The Service tried to examine the claims, but new claims were filed faster than previous filings could be examined.

An Oregon resident reportedly discovered 14 silver ingots in 1972 alongside an old wagon road blazed over the Willamette Pass in 1853. The discoverer believed the ingots were hidden by wagon-train pioneers about 120 years ago.

Iron and Steel.—The State Director of Industrial Development confirmed a report that a Portland steel firm and a Japanese exporter were negotiating a joint venture to bring raw Japanese steel into Oregon for finishing. The proposed finishing plant in Oregon was an existing facility in which the Japanese would acquire about a 50% interest.

Oregon Steel Mills Division of Gilmore Steel Corp., San Francisco, Calif., curtailed operations for about 1 week in 1972. Reasons given for the curtailment were to adjust production to market conditions. The curtailment closed the rolling facilities, affecting about 40 employees. Late in 1972 the situation had reversed itself, and Gilmore reportedly was considering expansion of its production facilities to meet the increased demand for steelplate.

Precision Castparts Corp. of Portland installed two new electric melting furnaces as part of its $200,000 expansion program designed to broaden its production capability of investment castings. The new 700-kilowatt facility included a 540-cycle power supply of advanced design and two furnaces, one of 1,000-pound capacity, the other of 3,000-pound capacity. The furnaces gave Castparts the capability to produce most of the air-melted stainless steel and cobalt-based alloys required in its manufacture of castings. The company already had a capability for producing vacuum alloy metals. Demands in 1972 for Castparts' stainless, cobalt-based, and other air-melted alloys were increased substantially by large volume orders for castings from turbine manufacturers.

Mercury.—Mercury production in 1972 decreased to zero principally as a result of an equally rapid decline in market prices coupled with environmental concerns. No mines produced mercury in Oregon in 1972; two mines produced mercury in 1971, and five mines in 1970. Some assessment and exploration work was done at one mine.

Molybdenum.—The president of Rem Metals Corp. announced that the company had achieved precision castings of molybdenum. According to company officials, the process would be used in manufacturing parts for turbine engines. Rem Metals expected to continue research on the process while expanding its base in the use of precision-cast titanium parts.

The U.S. Department of Defense announced in March 1972 that Oregon Metallurgical Corp. was awarded a $1 million contract for production of vane assemblies for Pershing missiles. The alloy consisted of 85% tungsten and 15% molybdenum.

Nickel.—Oregon's leading metal-mining operation, the Hanna Mining Co.'s nickel mine at Riddle, Douglas County, was again the only producer of primary nickel in the United States. Hanna processed 1,230,963 tons of nickel laterite ore grading 1.37% nickel. The ore contained 16,864 tons of nickel, 13,226 tons of which was recovered in 26,086 tons of ferronickel. This was a 1% decrease in nickel ore processed and a 1.2% increase in nickel recovered as ferronickel when compared with that of 1971. Hanna raised the price of ferronickel late in 1972 by 10 cents per pound to $1.38 per pound of contained nickel, f.o.b. Riddle, Oreg.

During 1972, nickel exploration activity in southwestern Oregon increased. Reportedly, there were two Canadian companies, International Mogul Mines Ltd., and Placer Inc. and two U.S. companies, Inspiration Consolidated Copper Co. and Atlantic-Richfield Co., active in southwestern Oregon and northwestern California during the year. Hanna was active filing claims on land at Pine Flat Mountain in California and Woodcock Mountain in Oregon.

Titanium.—Early in 1972 Oregon Metallurgical Corp. was negotiating with the Office of Emergency Preparedness to supply 750 tons of sponge titanium for the titanium sponge stockpile. About midyear, the General Services Administration (GSA) announced plans to purchase 7,000 tons of titanium metal sponge over the next 2 years, of which Oregon Metals was to supply 500 tons. The company was to reopen its new $9 million sponge facility at Albany, which was closed September 1971 because of low demand for titanium sponge. Plant startup will require 4 to 6 months and cost an estimated $1.5 million.

Ti-Line Inc., a subsidiary of Whittaker Corp., expected to increase its titanium castings production by yearend. The company operated a very large furnace at its Albany, Oreg. plant. The furnace was capable of handling molds 100 inches in diameter and 5 feet high.

Kawecki Berylco Industries, Inc. acquired a shareholding in Zirconium Technology Corp. in 1972 with the purchase of 400,000 shares for $400,000. Zirconium Corp. reported an operating loss of $325,185 in 1971. The operating loss continued into the first 2 months of 1972. However, later in 1972, the early trend was reversed, and the company reported the highest level of backlog orders in its history.

MINERAL FUELS

Geothermal Power.—The State Department of Geology and Mineral Industries received a grant, effective June 23, from the Federal Bureau of Mines to conduct a research program for targeting potential geothermal reservoirs. The grant from the Bureau totaled $76,000 with the State to contribute about $25,000. The study was to attempt to develop a technology whereby the heat flow in shallow drill holes (3 to 6 meters) could be used to target potential economic reservoirs of geothermal energy. At yearend the project was on schedule. Monitor wells (100 plus feet deep), which will be used to correct the effect of solar radiation in the shallow wells, had been established at four sites. One monitor well was in western Oregon near Portland, one in eastern Oregon 5 miles south of Vale, one near Boardman west of Pendleton on the Columbia-Umatilla Plateau, and the other one near Baker. Data from the monitor wells were being logged periodically. Drilling was recessed in late December until spring 1973.

The Governing Board of the Department of Geology and Mineral Industries issued the first permit for a geothermal well to Magma Energy, Inc., a subsidiary of Magma Power Co., Los Angeles, Calif., in 1972. The site chosen by the company for a 6,000-foot well was 1 mile east of Vale in southeastern Oregon. Gulf Oil Corp. reportedly had under lease 60,000 acres of private land north and south of Klamath Falls and in the Lakeview-Adel area. Reportedly, the land was to be used in exploring for geothermal reservoirs.

Nuclear.—At yearend, Portland General Electric Co.'s Trojan nuclear powerplant near Rainier, Oreg., was 60% completed. Plant cost estimates were increased during 1972 from the original $242 million to $298 million. The increase was attributed to added costs resulting from equipment delays, hiring of additional work crews, and added environmental studies and environmental control features. A 353-ton nuclear reactor vessel and two of four 350-ton steam generators were installed during 1972. Most of the plant's 60,000-cubic-yard-total concrete requirements had been poured by yearend. A visitor's information center was under construction and reportedly 35% complete. The center was expected to open in early summer 1973. Officials of Portland General Electric Co. announced late in 1972 that licensing and construction delays would hold up completion of the Trojan plant until July 1975. Jet-powered generating plants providing about 375 megawatts will be constructed in Portland and Salem as backup facilities and to fill energy gaps until the Trojan plant goes on line. Portland General Electric Co. delayed until 1973 its decision regarding the locations of additional nuclear power generating plants in Oregon. However, drilling crews were busy during 1972 testing for possible nuclear powerplant sites. In addition to test drilling, soil and rock samples were tested, and preliminary environmental impact surveys made on each site.

Proposals submitted by Chem-Nuclear Services, Inc., to store low-level radioactive wastes near Arlington, Oreg., were rejected by the Environmental Quality Commission (EQC). The company had been storing such wastes at a site near Arlington under a permit granted by the State Board of Health in 1969. The company also stored and disposed of numerous chemical wastes at the site. The company claimed it could not operate as a disposal company in Oregon if it could not accept radioactive wastes. EQC promised to reconsider the proposal if Chem-Nuclear could prove that it must accept nuclear wastes to remain in business.

Petroleum.—Petroleum exploration in Oregon was delayed by the State's demand for environmental impact statements. Environmental concern was instrumental in delaying the start of a wildcat well by Standard Oil of California in Malheur County, 80 miles north of McDermitt, Nev. Late in the year, EQC granted Standard a drilling permit; however, the company will not start drilling until 1973. Irrespective of environmental incumbrances, leasing activity remained at a high level during 1972. Mobil Oil Corp. filed lease applications in May for oil and gas rights on 89,000 acres of public lands in southern Lane and northern Douglas Counties. These applications represented the largest single group of filings on record for western Oregon. To date, the environmental impasse has resulted in Texaco, Inc., cancelling a drilling project near Paulina, Crook County, and American Oil Co., a subsidiary of Standard Oil Co. (Indiana), dropping its applications on 19,000 acres of State-owned land in Crook County.

Early in 1972 an ocean-bottom study by a three-nation team of scientists discovered sediment deposits off the Oregon and Washington coasts that should interest oil prospectors. The team, composed of American, Canadian, and Japanese scientists on the ship *Surveyor*, found the sediment in a trench at the base of the continental slope. The area was considerably further from shore than the area where companies prospected unsuccessfully several years ago.

Table 7.—Principal producers

Commodity and company	Address	Type of activity	County
NONMETALS			
Cement:			
Oregon Portland Cement Co.	111 Southeast Madison St. Portland, Oreg. 97214	Plant	Baker and Clackamas.
Clays:			
Central Oregon Bentonite Co.	Bear Creek Route Prineville, Oreg. 97754	Pit and plant	Crook.
Ceramco, Inc	P.O. Box 5 McMinnville, Oreg. 97128	do	Yamhill.
Columbia Brick Works	1320 Southeast Water St. Portland, Oreg. 97214	do	Multnomah.
Corvallis Brick & Tile Works, Inc.	P.O. Box 327 Corvallis, Oreg. 97330	do	Benton.
Empire Lite-Rock, Inc	9255 Northeast Halsey St. Portland, Oreg. 97220	do	Washington.
Klamath Falls Brick & Tile Co.	P.O. Box 573 Klamath Falls, Oreg. 97601	do	Klamath.
Mandrones Mining Co., Inc.	Rt. 1, Box 337 Molalla, Oreg. 97038	Pit	Clackamas.
McMinnville Brick Co	451 College Ave. McMinnville, Oreg. 97128	Pit and plant	Yamhill.
Monmouth Brick & Tile Co.	Rt. 1, Box 22 Monmouth, Oreg. 97361	do	Polk.

See footnotes at end of table.

Table 7.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Clays—Continued			
Monroe Clay Products Co.	P.O. Box A Monroe, Oreg. 97456	Pit and Plant	Benton.
Needy Brick & Tile Co.	Rt. 1, Box 102 Hubbard, Oreg. 97032	do	Clackamas and Marion.
Oregon Portland Cement Co.	111 Southeast Madison St. Portland, Oreg. 97214	Pit	Baker.
Scholls Tile Co.	Rt. 2, Box 208 Hillsboro, Oreg. 97123	Pit and plant	Washington.
Tillamook Clay Works	6690 Brickyard Rd. Tillamook, Oreg. 97141	do	Tillamook.
Willamina Clay Products Co., Inc.	9780 Southwest Hunziker St. Tigard, Oreg. 97223	do	Yamhill and Lane.
Diatomite:			
A. M. Matlock	P.O. Box 3307 Eugene, Oreg. 97402	Mine and plant	Lake.
Lime:			
Amalgamated Sugar Co.	Nyssa, Oreg. 97913	Plant	Malheur.
Ash Grove Cement Co.	101 West 11th St. Kansas City, Mo. 64105	do	Multnomah.
Pacific Carbide & Alloys Co.	P.O. Box 17008 Portland, Oreg. 97200	do	Do.
Perlite (expanded):			
Supreme Perlite Co.	P.O. Box 66 North Portland, Oreg. 97043	do	Do.
Pumice:			
Central Oregon Pumice Co.	5 Greenwood Ave. Bend, Oreg. 97701	Mine and plant	Deschutes.
Graystone Corp	Box 1087 Bend, Oreg. 97701	do	Do.
Chester Hiatt	147 North 12th St. Redmond, Oreg. 97756	do	Do.
Oregon Portland Cement Co.	111 Southeast Madison St. Portland, Oreg. 97214	Mine	Baker.
Jed Wilson & Son	Box 125 La Pine, Oreg. 97739	Mine and plant	Lake.
Roofing Granules:			
Flintkote Co.	P.O. Box 2744 Portland, Oreg. 97208	Plant	Multnomah.
Sand and gravel:			
Joe Bernet Towing Co.	P.O. Box 37 Wilsonville, Oreg. 97070	Pit	Clackamas.
Delta Sand & Gravel, Inc.	999 Division Ave. Eugene, Oreg. 97402	Pit and Plant	Lane.
Eugene Sand and Gravel Co.	Box 1067 Eugene, Oreg. 97401	do	Do.
Glacier Sand and Gravel Co.	5979 East Marginal Way Seattle, Wash. 98134	do	Multnomah.
Materne Bros	Box O Rosewood Station Spokane, Wash. 99208	Plant	Various.
Oceanlake Ready Mix Co.	1923 Highway 101 Lincoln City, Oreg. 97367	Pit	Lincoln.
Pacific Building Material Co.	3510 S.W. Bond Ave. Portland, Oreg. 97201	2 Pits and 2 Dredge.	Various.
Portland Rd. Driveway	7295 S.E. King Road Portland, Oreg. 97222	2 Portable and 2 Dredge Plants.	Clackamas.
Rich Valley Top Soil Co.	Box 30 Oregon City, Oreg. 97045	Pit and Plant	Do.
Willamette Hi-Grade Concrete Co.	Foot North Portsmouth Ave. Portland, Oregon. 97203	Dredge and Plant	Multnomah.
Stone:			
L. V. Anderson	Box 757 Oakridge, Oreg. 97463	Quarry and plant	Lane.
Beaver State Sand & Gravel, Inc.	Winchester, Oreg. 97495	Quarry	Douglas.
Boise Cascade Corp	La Grande, Oreg. 97850	Quarry and plant	Union, Umatilla, Wallowa.
L. H. Cobb	8275 Southwest 145th Ave. Beaverton, Oreg. 97005	do	Washington.
Eckman Creek Quarries	Box 15 Waldport, Oreg. 97394	do	Lincoln.
Goodat Crushed Rock	P.O. Box 488 Longview, Wash. 98632	Quarry	Columbia.
L. W. Govro	Rt. 4, Box 253-W Albany, Oreg. 97321	Quarry and plant	Linn.
Grant Construction Co.	Hayden Lake, Idaho	Quarry	Various.
Roy L. Houck Sons	1158 Chemeketa Northeast Salem, Oreg. 97301	Quarry and plant	Coos, Various.

See footnotes at end of table.

Table 7.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Stone—Continued			
Peter Kiewit Sons Co	Box 1777 Vancouver, Wash. 98663	Quarry and plant	Various.
Materne Bros	Box 0—Rosewood Station Spokane, Wash. 99208	do	Do.
Oregon Portland Cement Co.	111 Southeast Madison St. Portland, Oreg. 97214	do	Baker.
Pacific Crushing Co	610 Irving Drive Eugene, Oreg. 97402	do	Klamath, Lane.
Pioneer Construction Co	7881 Northwest St. Helens Rd. Portland, Oreg. 97229	do	Multnomah.
Quality Rock Co	Rt. 2, Box 608 Beaverton, Oreg. 97005	do	Washington.
Rogue River Paving Co., Inc.	1133 South Riverside Medford, Oreg. 97501	do	Goos, Douglas, Jackson, Josephine.
Roseburg Sand & Gravel Co.	Box 1207 Roseburg, Oreg. 97470	do	Coos, Douglas, Lane.
Sunset Crushed Rock	Clatsop Airport Astoria, Oreg. 97103	do	Clatsop.
Talc and Soapstone:			
John H. Pugh	2891 Elk Lane Grants Pass, Oreg. 97526	Mine	Josephine.
Vermiculite (exfoliated):			
Supreme Perlite Co	P.O. Box 66 North Portland, Oreg. 97043	Plant	Do.
Vermiculite-Northwest, Inc.	P.O. Box A Auburn, Wash. 98002	do	Do.
METALS			
Aluminum:			
Reynolds Metals Co	Troutdale, Oreg. 97060	do	Multnomah.[1]
Ferroalloys:			
Hanna Nickel Smelting Co.	Riddle, Oreg. 97469	do	Douglas.
Union Carbide Corp., Ferroalloys Div.[2]	Portland, Oreg. 97200	do	Multnomah.
National Metallurgical Co.	Springfield, Oreg. 97477	do	Lane.
Gold and Silver:			
Baker Assets Co	Baker, Oreg. 97814	Mine and mill	Baker.
Cornucopia Placer Co	Halfway, Oreg. 97834	Placer	Do.
Mercury:			
Alcona Mining, Inc	866 South 79th St. Springfield, Oreg. 97477	Mine	Douglas.
Nickel:			
Hanna Mining Co	Riddle, Oreg. 97469	do	Do.
Steel:			
Cascade Steel Rolling Mills, Inc.	McMinnville, Oreg. 97128	Plant	Yamhill.
Oregon Steel Mills	Portland, Oreg. 97200	do	Multnomah.
Titanium:			
Oregon Metallurgical Corp.	Albany, Oreg. 97321	do	Linn.
Rem Metals Corp	P.O. Box 829 Albany, Oreg. 97321	do	Do.
Tungsten:			
Frank Ramsey	3445 Court St. Baker, Oreg. 97814	Mine	Baker.
Zirconium:			
Wah Chang Albany Corp	Albany, Oreg. 97321	Plant	Linn.

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[1] Closed November 30, 1971.

[2] Produces ferromanganese and silicomanganese.

The Mineral Industry of Pennsylvania

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Pennsylvania Bureau of Topographic and Geologic Survey, Department of Environmental Resources, under a cooperative agreement for collecting information covering the mineral production from mines, quarries, and wells.

By Franklin D. Cooper [1]

Pennsylvania mineral production reached a record output value of $1,231.5 million, $82.4 million above that of 1971. Increases in value were attained by cement, clays, bituminous coal, lime, natural gas, sand and gravel, and stone. Output value decreases were noted for anthracite, copper, iron ore pellets, peat, crude petroleum, and zinc. The value of all natural gas liquids was 34% greater than 1971.

Compared with 1971 figures, the average f.o.b. mine value of anthracite increased 14 cents per ton and that of bituminous coal advanced 63 cents per ton. Collectively, solid-fuels production accounted for 63.3% of the total value of mineral production, and the value of all fossil fuels equaled 66.5% of total mineral production value. The production of anthracite was 18.6% less and its value was 17.6% less than in 1971. Bituminous coal production was 4.3% greater and its value was 11.9% greater than in 1971.

Leading mineral producing counties, with primary commodities in parentheses, were Washington, Greene, Indiana, Armstrong and Cambria (bituminous coal), Northampton and Lawrence (cement), and Schuylkill (anthracite). Cameron, and Pike Counties reported no mineral production. Pennsylvania led the Nation in stone production and was second in cement, third in lime and coal, and fourth in tripoli.

Table 1.—Mineral production in Pennsylvania [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Cement:				
Portland ……thousand short tons	7,850	$140,460	8,214	$156,008
Masonry ……do	419	11,247	451	12,401
Clays ……do	[2] 2,325	[2] 8,940	2,682	15,829
Coal:				
Anthracite ……do	8,727	103,469	7,106	85,251
Bituminous ……do	72,835	620,196	75,939	694,267
Copper (recoverable content of ores, etc.) short tons	3,349	3,483	2,611	2,673
Gem stones	NA	9	NA	9
Lime ……thousand short tons	1,760	30,008	1,891	33,802
Natural gas ……million cubic feet	76,451	20,770	73,958	22,389
Peat ……thousand short tons	38	461	22	320
Petroleum (crude) ……thousand 42-gallon barrels	3,798	17,699	3,441	16,414
Sand and gravel ……thousand short tons	19,668	36,162	18,757	36,804
Stone ……do	64,467	118,469	67,307	124,340
Zinc (recoverable content of ores, etc.) short tons	27,438	8,835	18,344	6,512
Value of items that cannot be disclosed: Clays (kaolin) (1971), cobalt (1971), gold (1971), iron ore, scrap mica, pyrites (1971), silver (1971), tripoli, and natural gas liquids	XX	28,899	XX	24,466
Total	XX	1,149,107	XX	1,231,485
Total 1967 constant dollars	XX	977,086	XX	p 1,024,472

p Preliminary. NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin; included with "Value of items that cannot be disclosed."

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[1] Physical scientist, Division of Fossil Fuels—Mineral Supply.

Table 2.—Value of mineral production in Pennsylvania, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	W	W	Stone, lime, clays.
Allegheny	$47,246	$60,548	Coal, cement, clays, sand and gravel, natural gas.
Armstrong	54,037	58,365	Coal, clays, sand and gravel, stone.
Beaver	W	3,689	Coal, sand and gravel, clays, lime.
Bedford	W	W	Stone, sand and gravel, coal.
Berks	32,734	35,241	Iron ore, cement, stone, clays, coal, sand and gravel.
Blair	W	W	Stone, sand and gravel.
Bradford	W	W	Sand and gravel.
Bucks	W	13,628	Stone, sand and gravel, clays.
Butler	21,022	25,870	Coal, cement, lime, stone, sand and gravel, clays.
Cambria	W	W	Coal, stone.
Carbon	4,304	W	Coal, sand and gravel, stone.
Centre	22,025	20,859	Lime, coal, stone, clays.
Chester	W	W	Stone, lime, clays.
Clarion	30,485	W	Coal, stone, sand and gravel, clays.
Clearfield	47,928	47,716	Coal, clays.
Clinton	W	W	Coal, stone, clays.
Columbia	3,776	W	Coal, sand and gravel, stone, peat.
Crawford	585	555	Sand and gravel.
Cumberland	W	W	Stone, sand and gravel, clays.
Dauphin	2,145	W	Stone, coal, sand and gravel.
Delaware	W	W	Stone.
Elk	W	W	Coal, natural gas liquids, stone.
Erie	W	W	Sand and gravel, peat.
Fayette	16,146	18,468	Coal, stone, clays.
Forest	312	W	Sand and gravel.
Franklin	W	W	Stone, sand and gravel.
Fulton	W	535	Stone, sand and gravel, coal.
Greene	80,060	100,067	Coal.
Huntingdon	W	W	Sand and gravel, coal.
Indiana	73,014	72,629	Coal.
Jefferson	W	W	Coal, clays, stone.
Juniata	--	366	Stone.
Lackawanna	W	4,848	Coal, peat.
Lancaster	9,868	W	Stone, coal, sand and gravel, clays.
Lawrence	32,345	33,367	Cement, stone, coal, sand and gravel, clays, peat.
Lebanon	W	17,040	Iron ore, lime, copper, stone.
Lehigh	29,111	28,226	Cement, zinc, stone.
Luzerne	37,585	31,059	Coal, sand and gravel, stone, peat, clays.
Lycoming	W	4,182	Sand and gravel, stone, coal, tripoli.
McKean	W	W	Clays, stone.
Mercer	W	3,512	Coal, sand and gravel, stone.
Mifflin	W	W	Sand and gravel, stone.
Monroe	W	W	Stone, sand and gravel, clays, peat.
Montgomery	W	W	Stone, cement, lime, clays.
Montour	W	W	Stone, lime.
Northampton	77,694	84,217	Cement, stone, sand and gravel.
Northumberland	11,372	W	Coal, stone, sand and gravel, clays.
Perry	W	W	Stone.
Philadelphia	W	--	
Potter	101	29	Stone.
Schuylkill	W	W	Coal, stone, sand and gravel, clays.
Snyder	W	W	Stone, coal.
Somerset	30,957	28,503	Coal, stone, clays, sand and gravel.
Sullivan	1,116	581	Coal.
Susquehanna	553	661	Stone.
Tioga	4,376	W	Coal, sand and gravel.
Union	W	W	Stone, clays.
Venango	W	W	Coal, sand and gravel, natural gas liquids.
Warren	1,115	1,261	Sand and gravel.
Washington	W	W	Coal, stone, clays.
Wayne	W	W	Stone.
Westmoreland	28,249	29,369	Coal, sand and gravel, stone.
Wyoming	W	W	Sand and gravel.
York	26,408	28,994	Cement, stone, lime, clays, sand and gravel, mica.
Undistributed[2]	422,445	477,102	
Total[3]	1,149,107	1,231,485	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Cameron and Pike Counties are not listed because no production was reported.

[2] Includes values of natural gas, natural gas liquids (1971), petroleum, gem stones and some sand and gravel and stone that cannot be assigned to specific counties, and values indicated by the symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Pennsylvania business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force ....thousands..	5,037.8	5,117.1	+1.6
Unemployment ....do....	261.5	271.3	+3.7
Employment (nonagricultural):			
Manufacturing ....do....	1,432.9	1,433.8	+.1
Construction ....do....	192.4	204.4	+6.2
Mining ....do....	38.1	40.2	+5.5
Transportation and public utilities ....do....	264.0	263.5	—.2
Wholesale and retail trade ....do....	840.3	862.3	+2.6
Finance, insurance, and real estate ....do....	194.4	201.4	+3.6
Services ....do....	696.0	715.4	+2.8
Government ....do....	629.2	650.2	+3.3
Personal income:			
Total ....millions..	$49,349	$53,029	+7.5
Per capita	$4,147	$4,457	+7.5
Construction activity:			
Value of authorized nonresidential construction..millions..	$384.0	$406.3	+5.8
Number of new residential units authorized	54,534	58,272	+6.9
Cement shipments to and within Pennsylvania thousand short tons..	3,538	3,428	—3.1
Mineral production value ....millions..	$1,149.1	$1,231.5	+7.2

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Non-Fatal	Frequency	Severity
1971:								
Bituminous coal	22,438	235	5,280	42,498	32	1,100	26.64	NA
Anthracite	5,028	250	1,259	9,315	5	553	59.90	NA
Metal	1,195	315	377	3,014	2	33	11.61	4,896
Nonmetal	1,170	253	297	2,401	--	91	37.90	848
Sand and gravel	1,075	235	252	2,243	--	83	37.00	934
Stone	7,494	277	2,073	17,132	2	280	16.46	1,449
Total [1]	38,400	248	9,539	76,604	41	2,140	28.47	NA
1972: [2]								
Bituminous coal	NA	NA	NA	NA	NA	NA	NA	NA
Anthracite	NA	NA	NA	NA	NA	NA	NA	NA
Metal	1,210	263	319	2,551	4	48	20.39	12,490
Nonmetal	915	261	239	1,961	2	67	35.19	8,628
Sand and gravel	930	227	212	1,853	1	82	44.78	4,135
Stone	6,165	279	1,720	14,394	2	250	17.51	1,462
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

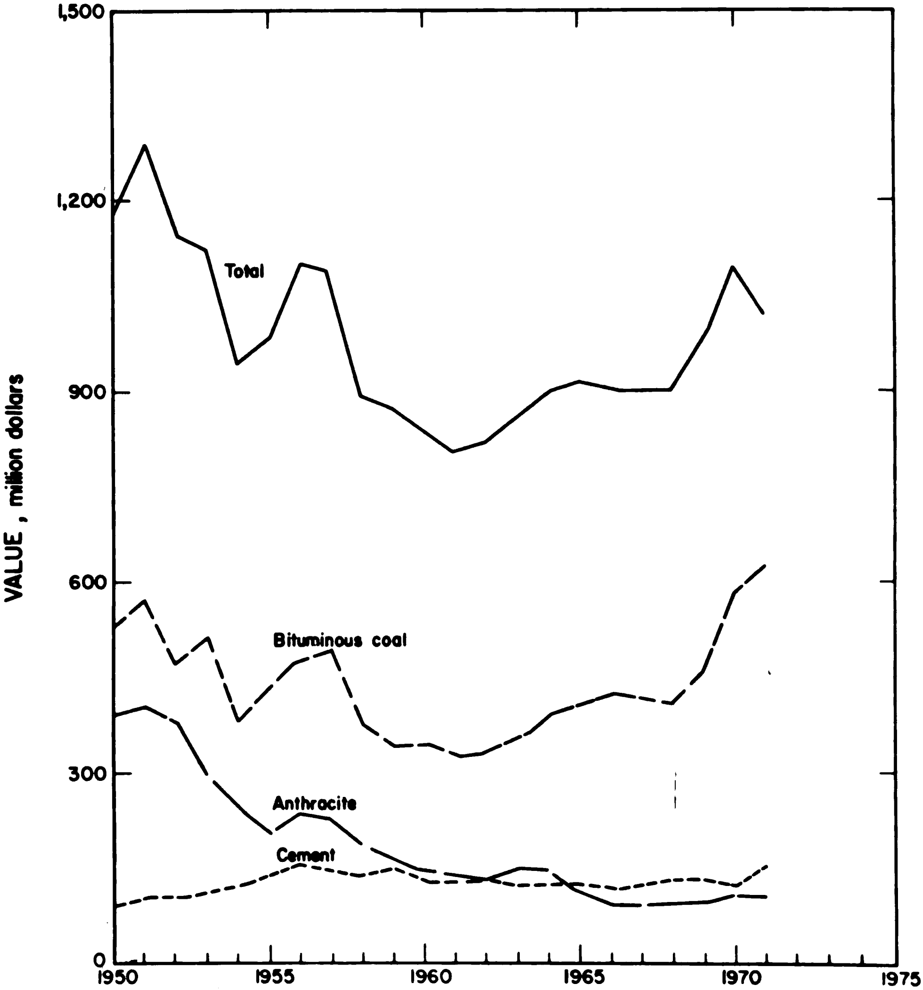

Figure 1.—Value of bituminous coal, anthracite, cement, and total value of mineral production in Pennsylvania.

Legislation and Government Programs.—Conservation legislation passed by the General Assembly and signed into law during 1972 comprised:

Act 20, providing for Interstate Air Pollution Agreements.

Act 153, an amendment to the Industrial Development Authority Law providing for loans to businesses conducting research and development on pollution control technology.

Act 154, providing for the inspection of emission control systems and making the removal of control devices unlawful.

Act 193, an amendment to the Land and Water Conservation and Reclamation Act decreasing the amount of money available for the prevention, control, and elimination of air pollution from abandoned burning coal refuse banks; increasing the amount of money available for the prevention of surface subsidence above abandoned mine operations; and for the control and extinguishment of surface and underground fires in abandoned mines.

Act 278, providing for a mine subsidence fund within the Department of Environmental Resources (DER) for insurance and compensation for damages to subscribers and for the payment and administration of funds by DER.

Act 355, an amendment to the Surface Mining and Reclamation Act further defining certain terms and further providing for license fees and exceptions.

Two contracts, totaling $1.7 million, were awarded in July by the Secretary of the Interior for a large-scale evaluation of advanced technology to prevent surface subsidence over flooded, abandoned underground mine workings. Under Bureau of Mines supervision, the project will experimentally backfill a 20-acre undermined area in the Green Ridge section of Scranton, using about 300,000 cubic yards of refuse from a massive local culm bank. The Empire Contracting Co., Old Forge, Pa., received one contract for crushing and hauling the refuse. A second contract for $900,000 went to The Dow Chemical Co.'s Dowell Division of Tulsa, Okla., to perform and monitor the 30-week backfill operation. One borehole was used to inject 177,000 cubic yards of fill material into the Clark bed. Four boreholes were used to inject 123,000 cubic yards of fill material into the New County bed. Formal dedication ceremonies were held October 20 when a complex pumping system was put into operation.

A letter of consent was granted November 14 by the U.S. Department of Housing and Urban Development (HUD) for expenditures up to $703,661 for the Minooka mine subsidence project. The letter enabled the Scranton Redevelopment Authority to use $883,832 of State funds without later losing the Federal grants expected after the project was finally approved and a loan-and-grant contract was signed.

The Bureau of Mines in a $291,450 demonstration project reclaimed strip-mined land surrounding the site for a $1.5 million anthracite museum to be built by the State in the Keyser Valley area adjacent to the Pennsylvania Turnpike. About 70 acres were cleared and contoured, new roads were built, new topsoil was spread, and the area was landscaped.

In late October, the Bureau completed two major mine fire control projects in Lackawanna County. The National Bank project was started in May 1971 and cost $661,000. The Carbondale project, started in July 1969 and costing $2,326,000, was one of the largest mine fire control projects undertaken by the Appalachian Regional Commission (ARC).

The Bureau awarded a $606,000 contract to Mine Safety Appliances Co. (MSA), Pittsburgh, for the design, manufacture, and installation of a comprehensive mine air surveillance and monitoring system in the Bureau's demonstration mine at Bruceton. The mine does not produce coal, being used solely for controlled experiments.

The Bureau received bids October 10 to build a pilot plant at Bruceton to demonstrate the Synthane coal-gasification process. It was estimated that the pilot plant would cost $10 million and would be completed in 19 months.

A coal mine safety training facility at Seward was dedicated on February 4. The facility was financed by a $223,105 Bureau grant under a cooperative agreement with the Central Pennsylvania Coal Producers Association. Six classes, of 32 miners each, ground mine fire in Warrior Run Borough, received 8 weeks of training. Penn State's College of Earth and Mineral Sciences supplied the faculty and classroom instruction materials.

Pursuant to the Appalachian Regional Development Act of 1965, as amended, active mining area restoration projects during 1972 comprised 9 mine-fire control projects; one costing $77,210 was started in Indiana County, one costing $1,858,391 was in progress in Columbia County, four costing $3,769,351 were in progress in Luzerne County, one costing $34,104 was completed in Allegheny County, one costing $2,633,415 was completed in Lackawanna County, and one costing $16,692 was completed in Washington County. No work was started, in progress, or completed on projects relating to subsidence control, surface mine reclamation, well sealing, or mine pollution control. All of the active projects had 75% Federal funding and 25% State funding.

Appalachia projects approved for Pennsylvania during 1972 in fields related to mining are listed in table 5.

The Stearns Service Co., Inc., in September 1971 started work to halt an under-Luzerne County, under a $773,080 ARC contract. Mine fire experts warned that if the fire was not controlled it might result in an $80 million loss and damage 8,800 homes in Ashley, Hanover Township, Nanticoke, Sugar Notch, and Warrior Run.

Work continued on the Kehley Run mine

Table 5.—Appalachia projects approved for Pennsylvania during 1972 in fields relating to mining

Project	County	Total cost	ARC funds	State funds	Local funds	Date approved
South Side Scranton mine subsidence.	Lackawanna --	$4,793,074	$3,594,803	$1,198,271	--	May 10
Hills Section mine subsidence, City of Scranton.	----do --------	8,228,220	6,171,165	2,057,055	--	Oct. 11
Dickson City Boulevard section, mine refuse bank reclamation.	----do --------	258,500	193,875	64,625	--	Oct. 16
Conemaugh generating station access road.	Indiana -------	772,000	300,000	--	$472,000	July 14
Parsons Area subsidence, City of Wilkes-Barre (emergency).	Luzerne ------	2,220,000	1,665,000	555,000	--	Oct. 25
Homer City electric generating station [1].	Indiana ------	880,000	561,000	--	319,000	([1])

[1] This project was submitted in July 1972 but at yearend had not yet received approval by the ARC.

fire near Shenandoah, Schuylkill County. The $10 million ARC project had been in progress 2 years.

In November, the Department of the Interior approved an ARC project to combat a fire in an abandoned Washington County coal mine by injecting dry fly ash into the mine to curtail the fire's air supply. The land surface above the fire will be plowed, sealed, and revegetated.

The Commonwealth's Department of Commerce continued its activities for encouraging the influx of new and the expansion of existing mineral-based-industrial operations. Projects in 36 counties that were approved under mortgage provisions of the Industrial and Commercial Development Authority Law of August 23, 1967, are listed in table 6.

Table 6.—Mineral-industry-related projects approved under mortgage provisions of the Industrial and Commercial Development Authority Law

(January 1 to December 31, 1972)

Project category	Number of projects	Number of loans	Mortgage amount (thousands)	Project cost (thousands)
Pollution control	23	27	$25,914	$26,285
Ferrous metals	18	41	22,716	23,305
Nonferrous metals	9	9	5,440	5,940
Electrical	6	8	4,018	4,139
Miscellaneous	4	6	1,454	1,454
Total	60	91	59,542	61,123

Table 7.—Mineral-industry-related pollution-control projects approved under revenue bond provisions of the Industrial and Commercial Development Authority Law

(January 1 to December 31, 1972)

County	Mortgage amount (thousands)	Project cost (thousands)
Allegheny	$40,000	$40,120
Beaver	22,500	22,500
Do	3,000	3,000
Butler	3,250	3,250
Centre	3,000	3,245
Delaware	120,000	120,000
Do	3,553	3,553
Lehigh	20,000	20,000
Northhampton	30,000	30,000
Total	245,303	245,668

DER and the Ely Con Development Corp. in February agreed on the final phase of a contract to extinguish a mine fire at Mt. Carmel, Northumberland County. The final cost reportedly will be $9.2 million, at least $832,000 under the original contract cost. DER will pay Ely Con $1.28 per cubic yard of solids excavated, and Ely Con will pay DER $4.75 per ton of anthracite extracted. DER by March 1972 had already paid out $4.8 million of the estimated total cost. At yearend 1971 the project was 60% completed. Part of the 200-foot-deep, 32-acre site had been burning for about 20 years.

An underground mine fire was extinguished in late November in the 4-foot vein of the former Grassy Island Colliery workings of the Hudson Coal Co., Olyphant, Lackawanna County. The mine fire, adjacent to a 2.5-million-ton culm bank, was extinguished after 150 hours of work costing about $9,000.

An acidic mine water treatment plant costing $1,589,000 on a 30-acre site along Rausch Creek near Valley View, Schuylkill County, attained full operation during May. The plant was designed to neutralize 32 million gallons per day of water from 18 abandoned mines, 25 active mines, and two preparation plants.

Cost data for Operation Scarlift contracts awarded or approved during 1972 are shown in table 8. Projects completed in the 4 years ending December 31, 1972, and their costs are shown in table 9.

Table 8.—Operation Scarlift cost data, 1972

Project category	Statewide		Anthracite				Bituminous			
	Contract and agreements awarded or approved in 1972		Contract and agreements awarded or approved in 1972		Construction projects completed in 1972		Contract and agreements awarded or approved in 1972		Construction projects completed in 1972	
	Number	Cost	Number	Cost	Number	Cost	Number	Cost	Number	Cost
Stream pollution abatement.	5	$210,365	2	$626,449	1	$102,167	12	$2,053,057	6	$1,130,041
Air pollution	--	--	2	2,170,930	2	2,651,912	--	--	1	26,401
Underground mine fires	--	--	--	--	--	--	1	46,900	5	195,114
Subsidence	--	--	--	--	2	222,582	2	66,710	11	331,218
Total	5	210,365	4	2,797,379	5	2,976,661	15	2,166,667	23	1,682,774

Table 9.—Operation Scarlift: Summary of projects completed in the 4 years ending December 31, 1972

Project category	Anthracite		Bituminous		Total	
	Number	Cost	Number	Cost	Number	Cost
Stream pollution abatement	21	$6,276,214	81	$8,766,763	102	$15,042,977
Air pollution	8	11,658,641	7	177,887	15	11,836,528
Underground mine fires	4	79,888	21	911,657	25	991,545
Subsidence	10	1,066,255	27	1,479,519	37	2,545,774
Total	43	19,080,998	136	11,335,826	179	30,416,824

The U.S. Geological Survey in March started a study, to be completed by yearend 1972, of underground mine water pools in the Wyoming Valley. DER in April awarded a $4,899 contract to install pumps at borehole sites. The study will permit DER to develop an overall plan to correct the acidic water discharged from the pools and to obtain gravity flow from the pools to reduce pumping costs.

DER received sealed bids April 20 for the removel of the Rotary mine refuse bank in the Parsons section of Wilkes-Barre. By October, the project had been one-half completed by Glasgow, Inc., of Glenside. About 1.25 million cubic yards of solids were to be loaded, transported, and spread on a low-lying area along the East End Boulevard in Plains Township. The removal of the refuse bank will provide a site for an industrial development project and will reduce the amount of acidic water and sediment entering Laurel Run Creek.

DER conducted mine subsidence evaluations to prevent subsidence damage at 28 future new school sites. The DER's Bureau of Land Protection inspected 246 underground mines and conducted 11 technical study projects to confirm and refine DER's subsidence control requirements.

The Susquehanna River on June 26 flooded the downtown first-floor headquarters of the Pennsylvania Geologic Survey in Harrisburg, and caused a $1 million loss of books, records, maps, and equipment. Libraries donated back collections of periodicals, and new maps were obtained from the U.S. Geological Survey. However, the Survey still needed journals and geological books. After moving into other quarters, the Survey estimated that to regain its full functions will require 2 years.

The Luzerne County Commissioners, on November 15, authorized DER to level a refuse bank in Wilkes-Barre Township. The project will reclaim 113 acres for an industrial site and will correct a water pollution problem.

According to DER's Bureau of Surface Mine Reclamation, the 740 total mining licenses issued or renewed during calendar year 1972 numbered approximately 385 to 390 for bituminous coal, 50 for anthracite, and 300 to 305 for all other minerals. For bituminous coal only, mine drainage permits totaled 352, strip mining permits totaled 805, performance bonds issued for 13,700 acres totaled $8,051,000, and bonds released totaled $3,930,000.

Waters from tropical storm Agnes washed out 142 highway bridges including 11 listed as major and critical. Most of the bridges spanned the Susquehanna River between Sayre and Harrisburg. The Pennsylvania Department of Transportation (Penn DOT) estimated the total damage to bridges alone at $500 million.

For the fiscal year July 1, 1971, through June 30, 1972, Penn DOT spent $372,837,928 for the construction of highways. Of this amount, $344,437,996 was spent on construction contracts and $28,363,932 was spent on highway construction by Penn DOT forces.

According to the U.S. Federal Highway Administration the status of the Interstate System in Pennsylvania as of September 30, 1972 was:

	Miles
Total mileage when completed	1,574
Free roads open to traffic	1,044
Total road (Pennsylvania turnpike) open	360
Total open to traffic	1,404
Roads under construction	71
Roads under design	99

Total cost of the 1,574-mile Interstate System is now estimated at $3,596 million, with completion forecast for 1978. Cost to date has been $2,361 million.

Publications released in 1971 and 1972 that related to the mineral industry of Pennsylvania included three by the Bureau of Mines,[2] 10 by the U. S. Geological Survey[3], seven by the Pennsylvania Geologic

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[2] Adams, L. M., J. P. Capp, and D. W. Gillmore. Coal Mine Soil and Refuse Bank Reclamation With Powerplant Fly Ash. Compost Science. J. Waste Recycling, v. 13, No. 6, 1972, pp. 20-26.

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[3] Averitt, P., and C. Lopez. Bibliography and Index of the U. S. Geological Survey Publications Relating to Coal, 1882–1970. U.S. Geol. Survey Bull. 1377, 1972, 173 pp.

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Survey[4], and five miscellaneous papers.[5]

Environment.—Environmental problems and their modification, conflicts of laws, and jurisdictional disputes were prominent in Pennsylvania's mineral-industry-related news. Many of the abatement projects were funded by a portion of the $500 million bond issue for conservation authorized in the May 1966 primary election. Pollution control projects approved under revenue bond provisions of the Industrial and Commercial Development Authority Law are listed in table 7.

The State received the brunt of tropical storm Agnes, whose rainfall in the June 20 to 25 period ranged from 4 inches near the Ohio border to 14 to 18 inches on portions of Dauphin, Lebanon, Northumberland, and Schuylkill Counties. Flood crests on the Susquehanna River were 15.5 to 18.5 feet above flood stage. The total estimated damage in the State was about $2 billion, twice the total amount in all other States affected by Agnes. Harrisburg and Wilkes-Barre sustained inordinate hardships.

Air Pollution.—The DER established new statewide standards for sulfur dioxide emissions for the first time. These standards, to satisfy compliance with Environmental Protection Agency (EPA) guidelines, replaced the standards in the Air Pollution Control Act of 1960.[6] The Pennsylvania air laws were adopted September 2, 1971, amended January 27, 1972, and became effective March 20, 1972.

In late May, EPA approved only three categories of DER plans, all of which were mandatory under the Federal Clean Air Act. Approval was made on compliance schedules, the review of new sources of air pollution, and the control and regulation of carbon monoxide. The 11 categories disapproved by EPA were legal authority, availability of data made public, sulfur oxides, particulate matter, photochemical oxidants, nitrogen oxides and hydrocarbons, emergency episodes, surveillance of air quality, resources, surveillance sources, and intergovernment cooperation.

EPA regulations required the DER's Environmental Quality Board to implement plans for NO_x control. However, the control strategy published in the Federal Register related only to gas- and oil-fired boilers and contained no limitations for coal-fired equipment.

The DER did not collect information on air pollution control installations made in 1972 in 65 counties, other than Allegheny and Philadelphia Counties, because such information was not required for Federal grant applications.

Expenditures for emission reduction equipment completed or to be installed in Philadelphia County in 1972–73 comprised $290,000 total for electrostatic precipitators to collect 53.0 total tons per year of particulates at three nonferrous industries, $340,000 total for one baghouse and one high-energy filtration system to collect 237.3 tons per year of particulates at two asphalt plants; and $400,000 for one baghouse to collect 365 tons per year of particulates at the coke-screening operation of the Philadelphia Coke Division, Eastern Gas and Fuel Associates. One Philadelphia County petroleum refinery continued work in the third year of a 5-year Comprehensive Refining Control Program that will cost $16.5 million for storage tank conversions, bulk loading terminal controls, sulfur recovery facilities, process and equipment modifications, and combustion controls. When completed, the program was expected to eliminate the annual emissions of 7,320 tons of hydrocarbons, 9,835 tons of sulfur dioxide, and 9,540 tons of carbon monoxide.

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[5] Bureau of Mines—Atlantic Richfield Co. Pennsylvania and Its Natural Resources. 16mm. color, sound films; 27 minutes. Available for short-term loan from Motion Pictures, Bureau of Mines, U.S. Department of the Interior, 4800 Forbes Avenue, Pittsburgh, Pa. 15213.

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[6] Department of Environmental Resources. Pennsylvania Air Pollution General Rules. Title 25, Rules and Regulations; Part 1, Subpart C, Article III, Air Resources. September 1971, 55 pp.

Allegheny County was foremost in the State's pollution news and activities. The Allegheny County Health Department (ACHD) operated 49 air-monitoring stations that indicated an overall 8% decrease in particulate levels and a 33% decrease in sulfur dioxide levels compared with the 1971 overall levels.

ACHD's plans were directed to achieve EPA primary air quality standards by 1975. Interim measures planned for 1973 included a survey of area plants to identify emissions and to develop programs for compliance with ACHD's new air pollution standards, the annual review and issuance of permits for air pollution sources, and the relocation of the Courthouse monitoring station accompanied by the addition of devices for measuring nitrogen oxides, ozone, and hydrocarbons.

ACHD's new air pollution code, effective June 15, was more stringent than the 1970 code. Sulfur dioxide limits were lowered another 60% to 75%; 90% of the sulfur had to be removed from coke oven gas; the number of blast furnace slips was limited; and the limit on particulates emitted from powerplants, steel plants, and iron foundries was lowered. Smoke limits were reduced 50%, and Ringelmann No. 3 or darker was classed as a violation at any time.

The DER's Division of Mine Drainage and Erosion issued 23 water permits to operators of underground bituminous coal, limestone, and clay mines.

A 500,000-gallon-per-day (gpd) mine wastewater treatment plant was completed in Indiana County. The water treatment, based on the relatively new Desal process developed by the Rohm and Haas Co., used an ion-exchange resin capable of operation in the presence of bicarbonates. The aqueous effluent was aerated to precipitate iron and manganese. The total cost for treating a typical acidic mine water containing 1,000 parts per million (ppm) iron was estimated at about 30 cents per 1,000 gallons.[7]

The Burgettstown demineralization plant operated by the Smith Township Municipal Authority was described.[8]

A 3-day program relating to the control of water pollution from coal mining was held at Penn State October 4 through 6. Included were discussions on preventing and minimizing drainage formation, treatment procedures, and governmental regulations.

The Fourth Symposium on Coal Mine Drainage Research was held April 27 at the Mellon Institute in Pittsburgh. More than 400 attendees heard 32 technical papers on the remaining problems and emerging answers of mine drainage control. The biennial symposium was organized by Bituminous Coal Research, Inc. (BCR), Monroeville, with program planning help from EPA, DER, and the Ohio River Valley Sanitation Commission (ORANSCO).

Solid Wastes.—The EPA approved a $103,000 grant in November for a 6-month study of the feasibility of moving refuse from Philadelphia by railroad to abandoned anthracite strip mine pits. If the idea appears practical, Philadelphia will be eligible for a $551,000 EPA grant to complete the plan, which hopefully would be operable in June 1974.

DER denied Lycoming County's application to use a bituminous coal strip mine in Cogan House Township for landfill purposes. The denial was based on the possible pollution of underground water and insufficient ground cover material at the site.

At yearend, the chairman of the State's House Conservation Committee recommended a feasibility study on returning coal wastes underground and on finding new uses for such wastes.

Two abandoned strip pits in Zerbe Township were considered as sanitary landfill sites for 80,000 tons of solid wastes generated annually in Northumberland County.

DER approved the cost of a reclamation project at a culm bank near the Boulevard Redevolopment Area in Dickson City, Lackawanna County.

The Montgomery County Redevolopment Authority awarded a $46,000 contract to the University Science Center, Philadelphia, to determine if some profitable, or at least useful, use could be found for 1.5 million cubic yards of waste carbonate, magnesia, and asbestos that have accumulated since 1867 on a 25-acre site in downtown Ambler. The authority wanted the site for an urban renewal housing project.

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[7] Engineering and Mining Journal. Searching for Solution to Pollution Problems. V. 173, No. 6, June 1972, pp. 178–183.

[8] Zabbin, W., T. Fithian, and D. R. Maneval. Converting AMD to Potable Water by Ion Exchange Treatment. Coal Age, v. 77, No. 7, July 1972, pp. 107–111.

Laboratory tests continued in 1972 on the use of sewage plant sludge and effluent water as fertilizing agents to induce the growth of vegetation on acidic spoil banks at solid fuel strip mines. These tests had been in progress since 1968 under the Penn State Waste Water Conservation and Renovation Research Program funded by a grant from the Office of Water Resources Research (OWRR) of the U.S. Department of the Interior. The project was to be demonstrated in 1973 on an extensive acreage of nonproductive spoil banks and some forest areas.

At U.S. Steel's Frick District Robena coal preparation plant, 500 tons of fly ash was spread to a 6-inch depth on a 4-acre experimental refuse area to determine the capability of fly ash as a soil conditioner.

U.S. Steel converted 60 acres of its main slag dump area, known as Brown's dump, as a site for a shopping center near Pittsburgh. The dump was separated from the shopping center by a high terrace.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Anthracite).—The 7,106,295-short-ton production, the smallest in 10 consecutive years, was 18.6% less than in 1971 and was 17.6% less in value. The average value of all production increased 14 cents to $12.00 per ton.

Compared with 1971, decreases in production were as follows: underground 26.7% strip, 22.3% and culm bank, 14.4%. Production of dredged coal was 22.3% greater than in 1971. River dredged anthracite accounted for 6.1% of the State's total production and 3.5% of its total value.

Twelve companies, each of which produced more than 200,000 tons, produced 4,271,966 tons or about two-thirds of the State's production, excluding that from dredging.

According to DER data, production originated from 117 underground mines, from 115 strip mines operated under 149 stripping permits, from 63 culm banks operated by 37 companies, and from river dredging by eight companies. Production of 6,629,503 short tons, excluding 476,792 tons from dredging operations, was processed at 55 breakers, 13 cleaning plants, one sizing plant, and five washeries. Essentially, all of the washing and cleaning were performed using dense-medium vessels, cyclones, and Wemco-type cones.

Production by counties is shown in table 10.

Table 10.—Pennsylvania: Anthracite production and value by county

(Thousand short tons and thousand dollars)

County	Production [1]	Value [1]
Carbon	183	2,042
Columbia	98	1,475
Dauphin	47	485
Lackawanna	311	4,827
Luzerne	2,097	28,567
Northumberland	901	9,345
Schuylkill	2,924	34,980
Sullivan	68	582
Total [2]	6,629	82,253
Dredge production, total [3]	477	2,998
Grand total	7,106	85,251

[1] For shipments leaving possession of producing companies; does not include selling expense.

[2] Excludes dredged production.

[3] For Berks, Dauphin, Lancaster, Northumberland, and Snyder Counties.

The total production and its value are distributed as follows:

	Production (thousand short tons)	Value (thousand dollars)	Value (per ton
Shipped by railroad	2,601	31,338	$12.05
Shipped by truck	4,017	50,696	12.62
Colliery fuel	11	172	15.64
Dredge coal	477	3,044	6.38
Total	7,106	[1] 85,251	12.00

[1] Data do not add to total shown because of independent rounding.

Commercial exports, principally to Canada and Western Europe, totaled 743,451 short tons, 72,451 tons more than in 1971, and were valued at $10,921,970. Commercial exports through Philadelphia totaled 551,987 tons and included a record cargo of 30,850 tons loaded November 29 and consigned to Dunkerque, France. The Federal Government purchased 447,728 short tons, compared with 718,000 short tons in 1971, to supply most of the solid-fuel needs of the U.S. Armed Forces in West Germany.

Domestic consumption in short tons comprised 2,960,000 for residential and commercial heating, 603,000 for miscellaneous industrial uses, 1,584,000 for electric utilities, 474,000 for coke plants, 283,000 for sintering and pelletizing, and 11,000 for colliery fuel.

Approximately 110 small underground mines that produced about 1 million tons in 1971 in the Western Middle, Southern, and Eastern Middle fields were flooded in late June 1972. Reportedly, the net result was an estimated annual loss of 1.17 million tons of production and the employment of 1,800 mining personnel and 1,800 affiliated service employees. Only a few underground mine operators were financially able to rehabilitate the flooded mines.

On the basis of salable production, the loading of coal in underground mines was done by 10 mobile loading machines for 135,728 tons, by 52 scraper loaders for 346,884 tons, by one duckbill for 1,929 tons, by 39 hand-loaded face conveyors for 109,456 tons, and by hand loading for 350,318 tons. The consumption of permissible explosives averaged 0.808 pound per ton of underground production.

Equipment used in strip mines included 60 front-end loaders, 19 electric shovels, 33 diesel shovels, 42 electric draglines, and 68 diesel draglines. Equipment used at culm banks included 43 front-end loaders, eight diesel shovels, one gasoline powered dragline, and seven diesel draglines.

The reclamation of strip-mined land comprised 147 acres provided with grass seed, lime, and fertilizer, and 142 acres planted with 185,000 seedling trees and 12,000 wildlife-cover shrubs furnished by the Pennsylvania Game Commission. This was the first use of such shrubs on reclaimed stripped land in the State.

One fatal accident occured in underground mines and two in strip mines. The entire anthracite industry had 272 nonfatal accidents.

Comparative productivity data for 1971 and 1972, shown in table 11, indicate that the average productivity based on tons of total salable production, excluding that from dredging, was 6.0% greater in 1972.

Table 11.—Pennsylvania: Anthracite productivity data, 1971–72

Activity	Production (short tons) 1971	Production (short tons) 1972	Man-days [1] 1971	Man-days [1] 1972	Productivity (tons per man-day) 1971	Productivity (tons per man-day) 1972	Change, percent
Deep mined:							
Extraction	1,245,326	896,991	304,298	197,242	4.09	4.55	+11.2
Preparation [2]	1,245,326	896,991	55,437	41,654	22.46	21.53	−4.1
Total or average	1,245,326	896,991	359,735	238,896	3.46	3.75	+8.4
Strip mined:							
Extraction	4,450,457	3,492,444	531,960	393,825	8.37	8.87	+5.9
Preparation [2]	4,450,457	3,492,444	198,119	102,205	22.46	21.53	−4.1
Total or average	4,450,457	3,492,444	730,079	556,030	6.10	6.28	+2.9
Culm bank:							
Extraction	2,492,178	2,072,658	79,044	48,656	31.53	42.60	+35.1
Preparation [2]	2,093,906	2,072,658	93,214	96,242	22.46	21.53	−4.1
Total or average	2,492,178	2,072,658	172,258	144,898	14.47	14.30	−1.2
State total:[3]							
Extraction	8,187,961	6,462,903	915,302	639,723	8.95	10.10	+12.8
Preparation [2]	7,789,689	6,462,903	346,770	300,101	22.46	21.53	−4.1
Total or average [4]	8,187,961	[5] 6,462,903	1,262,072	939,824	6.49	6.88	+6.0

[1] Includes personnel engaged in maintenance, haulage, stripped-land surface reclamation, etc.
[2] Comprises breakers, cleaning plants, bagging plants, and sizing pockets.
[3] Excludes dredged product.
[4] Includes production without preparation comprising 398,272 tons from culm banks.
[5] Includes undiscloseable production sold without preparation, from culm banks.

Note: All data in this table were derived from annual reports published by the Anthracite and Bituminous Division of the Pennsylvania Department of Environmental Resources that summarize mandatory monthly reports submitted by the anthracite industry.

A member of the Anthracite Conservation Association, during a March 28 meeting of the Economic Development Council of Northeastern Pennsylvania, cited the following reasons for the decline of deep-mined U.S. anthracite production: Lack of confidence that discouraged investments, lack of research to develop new markets. lack of employment appeal, costlier deep mining because of inflationary pressures, restrictive State and Federal legislation that discouraged development and increased costs to an already burdensome level, and a public image of environmental damage.

A 3-year contract that raised the pay of anthracite miners to $29 per day was accepted by the United Mine Workers Union (UMWA) negotiators on April 16. The new contract included a $5-per-day wage increase retroactive to April 1, 1972 and an equal raise effective April 1, 1973 and April 1, 1974.

An Anthracite Industry Study Committee, comprising industry and UMWA members, was created by the 1972 contract. In late November, this committee met with Governor Shapp and urged his administration to seek ways to help stop the decline of the industry. In the 1-day session, Penn State faculty members presented the current state of technology and the possibilities of improvements in various phases of the anthracite problem. One suggestion for the short-term was to promote the use of anthracite in urban areas where low-sulfur fuel was a requirement established by the EPA. The long-term promotion involved the production of pipeline-quality gas and the generation of electricity in steam-electric plants using the French-developed Ignifluid combustion process. Based on the current value of anthracite, the estimated value of the anthracite in Pennsylvania's reserves was reportedly $88 billion.

Tropical storm Agnes resulted in subsidences near homes in Mahonoy City, in the Craigs and Hill sections of Mahonoy Township, and in the Glenn Lynn and Parsons section near Wilkes-Barre. A mudslide closed the entry of the abandoned Lincoln Colliery near Mollystown and impounded an estimated 40 million gallons of water that flooded the active deep mine of the Zimmerman Coal Co. A mine flushing project was started during late July in the affected Parsons section of Wilkes-Barre. About 2 months were required to pump 10,000 cubic yards of screened culm bank solids into voids of the near-surface Kidney and Rock veins.

The DER on June 12 ordered immediate action to improve the stability of three silt basin impoundments. Orders were sent to the Harry E. Coal Co. breaker at Swoyersville; the New St. Nicholas breaker at Duncott, Schuylkill County; and the Leon E. Kocher Coal Co. breaker in Hegins Township, Schuylkill County. A new silt dam satisfying DER's requirements was under construction at the New St. Nicholas breaker at the eastern end of the existing giant silt basin. The Environmental Hearing Board asked the DER to make a further study of a silt basin owned by the Leon E. Kocher Coal Co. in Valley View before use of the basin could be halted. The Board noted a conflict between DER's rules that left the burden of proof to the company to show that the basin was safe and the Board's rules that placed the burden of proof on the DER to prove that the basin was unsafe.

The DER on July 26 ordered Manbeck Dredging, Inc., Schuylkill Haven, to stop the discharge of silt into a basin behind an unsafe dam. The DER filed suit July 31 in Schuylkill County Court against Phoenix Contracting Co. for allegedly dumping waste materials from its abandoned coal washery north of Sheridan in Porter Township into an adjacent waterway.

The State spent about $120,000 for electricity in 1972 to pump acidic mine water into the Susquehanna River in the Hudson section of Plains Township. The State acquired in April, 1 acre of land in Hollenback Park, Wilkes-Barre, for a pumping station to stabilize the water level in the abandoned Pine Ridge Colliery mine. The station will discharge water into the nearby Mill Creek.

Table 12 shows the number of underground and surface mines opened annually in the 1970–72 period, their estimated annual production, and the number of employees.

Table 13 shows the number of underground anthracite mines that were permanently abandoned since December 1969 in six counties, their estimated annual tonnage, and the number of employees affected. The number of reasons given for the mine abandonments in the 1970–72 period were as follows: 25, worked out; 15, economic conditions; 10, maintenance too costly; six, water conditions; five, lack of

Table 12.—Pennsylvania: Anthracite mines opened in the 1970–72 period

Type of mine	Number of mines	Estimated annual production (thousand tons)	Number of employees
Underground:			
1970	--	--	--
1971	3	14	15
1972	2	3	5
Total	5	17	20
Surface:			
1970	--	--	--
1971	19	1,137	161
1972	12	740	46
Total	31	1,877	207

Source: Bureau of Mines, Coal Mine Health and Safety, District 1.

Table 13.—Pennsylvania: Underground anthracite mines permanently abandoned since December 1969

County	Number of mines	Estimated annual production (short tons)	Number of Employees
Schuylkill:			
1970	11	64,750	41
1971	14	107,750	82
1972	12	61,250	55
Total	37	233,750	178
Luzerne:			
1970	2	138,750	157
1971	1	5,000	6
1972	1	45,000	4
Total	4	188,750	167
Northumberland:			
1970	9	74,500	59
1971	6	34,250	34
1972	7	22,500	22
Total	22	131,250	115
Carbon:			
1970	--	--	--
1971	1	3,750	2
1972	1	22,500	11
Total	2	26,250	13
Dauphin:			
1970	1	3,500	3
1971	--	--	--
1972	--	--	--
Total	1	3,500	3
Lackawanna:			
1970	--	--	--
1971	--	--	--
1972	1	2,500	4
Total	1	2,500	4
Totals:			
1970	23	281,500	260
1971	22	150,750	124
1972	22	153,750	96
1970–72	67	586,000	480

Source: Bureau of Mines, Coal Mine Health and Safety, District 1.

manpower; four, no market for low-quality product; and two, Federal closures.

Coal (Bituminous).—The 75.94-million-tons of production was valued at $694.27 million, equal to an average f.o.b. mine value of $9.14 per ton compared to $8.51 per ton in 1971. Open market sales totaled 56.69 million tons and averaged $8.06 per ton at the mine, and 19.25 million tons of captive coal averaged $12.32 at the mine.

Approximately 50.4 million tons was transported by rail or water, including 18.2 million tons by unit train, 8.1 million tons by conveyor belt, and 17.0 million tons by truck. The remainder of the total production, or about 440,000 tons, was used for local domestic heating, for heat and power generation at mines, and in beehive coke production.

Washington, Greene, Indiana, Cambria, and Armstrong Counties produced 39.04 million tons, or 79.5%, of the total deep-mined coal. Clearfield, Clarion, Armstrong, Somerset, and Indiana Counties produced 15.42 million tons, or 58.7%, of the total strip-mined coal. Armstrong, Somerset, Indiana, Jefferson, and Clearfield Counties produced 364,000 tons, or 67.2%, of the total auger-mined coal. Collectively, Washington, Greene, Indiana, Armstrong, and Cambria Counties produced 46.40 million tons, or 61.1%, of the State's total bituminous coal production.

Active mines producing more than 1,000 tons per year totaled 836; 159 were deep mines, 22 fewer than in 1971; 622 were strip mines, 95 more than in 1971; and 55 were auger mines, two fewer than in 1970.

The 49.13-million-ton underground production had an average f.o.b. mine value of $10.39 per ton, compared with an average f.o.b. mine value of $9.88 per ton for the 44.29-million-ton underground production in 1971.

Seventy-one mechanical cleaning plants, three more than in 1971, produced 45.6 million ton of salable coal and 16.0 million tons of refuse. The percentages of cleaned coal by origin were deep mines, 86.19; strip mines, 13.74; and auger mines, 0.07. Wet washing equipment by types and their production of cleaned coal in million tons were as follows: table, 4.2; launders, 1.4; froth-flotation, 1.9; dense medium, 17.6; classifiers, 0.4; and jigs, 12.7. Pneumatic-type equipment produced 7.4 million tons of cleaned coal.

Thirteen plants operated 21 thermal drying units to produce 5.57 million tons. One hundred forty-nine plants crushed 57.5 million tons of coal.

Shipments of new equipment to the State's underground coal mines in 1972 included two mobile loaders, 53 continuous miners, four longwall units, 10 shuttle cars, 54 rubber-tired tractors, 39 battery-powered front-end loaders, 189 rubber-tired mine cars, and 76 gathering and haulage conveyors.

The Alpine Equipment Corp., State College, Pa., sold 18 mining machines in the United States in 1972. Thirteen machines went to underground coal mines including two shipped to Pennsylvania mines.

Continuous mining machines totaled 498, three fewer than in 1971, and produced 43.0 million tons of coal, 5.43 million tons more than in 1971. These machines comprised ripper, boring, rotary drum, and oscillating-disk-head types. Because 41 machines were not designed to perform loading, 41 mobile loaders were teamed with them to load 4.06 million tons from the mine floor. Fifty-five continuous-mining machines mined and loaded 3.13 million tons onto feeder-conveyors, and 402 machines mined and loaded 35.79 million tons into shuttle cars and rubber-tired mine cars.

Twelve longwall sytems produced 2,353,615 tons of coal, 428,615 tons more than the 1,925,000 tons produced by nine longwall systems in 1971. In 1972 one planer-type installation produced 264,887 tons, and 11 shearer-type installations produced 2,088,728 tons.

Twelve mobile loaders discharged 407,564 tons into mine cars or onto conveyors, and 3,239,650 tons was loaded into shuttle cars and rubber-tired mine cars by 56 mobile loaders. A total of 135,434 tons was loaded by duckbills, scraper loaders, and hand-loaded face conveyors, and by hand.

A total of 70 cutting machines, 65 fewer than in 1971, were used to cut 2,641,462 tons. Coal shot from the solid totaled 3,609 tons.

Coal drilling by 54 hand-held or post-mounted drills, 26 fewer than in 1971, was used to produced 2,221,405 tons, and 21 mobile drills, 17 fewer than in 1971, were used to produce 2,393,861 tons.

Roof bolting employed 318 rotary drills, 42 more than in 1971, and 231 percussion drills, 34 fewer than in 1971. Roof or rock drills used for other purposes included 15 rotary drills, 23 fewer than in 1971, and 20 percussion drills, 12 less than in 1971.

Seventy-six mines installed 8,006,369 roof bolts, all new, either as the sole method of roof support or in conjunction with other roof support materials. These 76 mines produced 45,060,662 tons of coal including 40,834,602 tons produced under roof supported only by bolts.

Equipment used to haul run-of-mine coal, rock, operating supplies, and personnel in deep mines included 1,102 trolley locomotives, 80 more than in 1971; 38 battery-powered locomotives, 30 fewer than in 1971; 12,376 rail mine cars, 200 fewer than in 1971; 498 miles of mainline track and 295 miles of other track; and 634 gathering and haulage conveyor belts, 15 more than in 1971, averaging 2,010 feet in length and totaling 260.3 miles compared with 225.1 miles in 1971. Considerable intermediate haulage was done by 1,072 cable reel shuttle cars and 19 battery-powered shuttle cars, eight shuttle buggies, 287 rubber-tired tractors, and 587 rubber-tired trailers.

Strip-mining equipment included 436 power shovels, 31 fewer than in 1971, and 301 draglines, 24 fewer than in 1971. Approximately 96.7% of the total number of shovels and draglines were classed as diesel-electric and diesel, and 74% were rated at less than 5-cubic-yard capacity. Of the 46 carryall scrapers in operation, eight fewer than in 1971, 12 were rated at less than 15-cubic-yard capacity. Other strip-mining equipment included 862 bulldozers, 25 horizontal drills, 146 vertical drills, 465 front-end loaders, eight wheel excavators, one power broom, 38 motor graders, and nine coal drills. No data were available on the truck haulage of run-of-mine coal. The 26.26-million-ton strip-mined production averaged $6.86 per ton f.o.b. mine, compared with a $6.41 per ton f.o.b. mine value for the 28.0-million-ton production in 1971. The C & K Coal Co. was the largest producer of strip-mined coal, with 2.2 million tons from 11 operations, all in Clarion County.

Active equipment for auger mining included 40 augers, 28 bulldozers, two carryall scrapers, one diesel shovel rated at less than 5-cubic-yard capacity, and four front-end loaders. The 542,115-ton auger-mined production averaged $6.37 per ton at the mine, compared with a $6.04 per ton average f.o.b. mine value for the 544,211-ton production in 1971.

Table 14.—Pennsylvania: Bituminous coal production, by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands) [2]
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total [1]	
Allegheny	7	10	--	17	3,780	771	--	4,551	$44,890
Armstrong	19	59	11	89	5,241	2,539	96	7,876	55,992
Beaver	1	3	4	8	130	122	32	284	2,117
Bedford	1	--	--	1	1	--	--	1	W
Butler	4	31	2	37	565	977	54	1,596	9,715
Cambria	20	21	--	41	6,401	968	--	7,368	95,201
Centre	1	13	--	14	448	618	--	1,067	8,132
Clarion	--	62	--	62	--	4,281	--	4,281	31,120
Clearfield	10	97	6	113	1,094	4,568	55	5,718	40,873
Clinton	--	11	--	11	--	240	--	240	1,609
Elk	--	14	4	18	--	336	31	367	2,424
Fayette	3	50	1	54	780	1,095	18	1,893	15,269
Fulton	--	1	--	1	--	1	--	1	W
Greene	15	26	--	41	8,158	950	--	9,109	100,067
Indiana	29	49	8	86	6,767	1,624	66	8,456	72,629
Jefferson	5	39	5	49	48	1,267	61	1,376	10,108
Lawrence	--	16	4	20	--	525	15	540	3,353
Lycoming	--	3	--	3	--	127	--	127	W
Mercer	--	3	--	3	--	319	--	319	W
Somerset	20	64	8	92	1,382	2,310	86	3,777	25,699
Tioga	--	1	--	1	--	662	--	662	W
Venango	--	9	--	9	--	361	--	361	1,852
Washington	17	13	2	32	12,476	1,085	29	13,589	145,941
Westmoreland	7	27	--	34	1,862	518	--	2,380	20,749
Total [1]	159	622	55	836	49,133	26,264	542	75,939	694,267

W Withheld to avoid disclosing individual company confidential data; included in "Total."

[1] Data may not add to totals shown because of independent rounding.

[2] Value received or charged for coal f.o.b. mine.

Lamps used in underground mines, according to DER data, totaled 24,781 and comprised one open-type, 4,699 flame-safety-type, and 20,081 electric-type. DER reported 19 fatalities relevant to deep mines comprising eight by roof falls, five by transportation, one by machinery, one by electricity, one by outside machinery, and three by outside transportation.

Table 15 shows DER data relating to production from underground mines, classified as gaseous or nongaseous by various coal beds.

Table 16 compares bituminous coal productivity data for 1971 and 1972, based on DER's summarized reports.

Table 17 contains bituminous coal strip and auger mining data.

Table 18 summarizes data for underground fuel-coal-producing mines permanently abandoned in 1970, 1971, and 1972 with reasons for the permanent closure. Data for this table and the reasons for permanent abandonment were obtained from the Mining Enforcement and Safety Administration, U.S. Department of the Interior.

Gulf Resources & Chemical Corp. expanded strip-mining operations in Clarion County to attain a minimal annual production of 1 million tons of steam-grade coal by mid-1972. The operations were handled by the Vantage Coal Corp., a newly formed subsidiary of Gulf Resources. Another subsidiary, The C & K Coal Co., Clarion, operated 11 widely scattered pits, known as the Fox mine, in the Rimersburg-Sligo area of Clarion County and coal-cleaning plants at Rimersburg and Piney Fork, and was the largest strip-mined coal producer in the State. Most C & K's overburden drilling was done by two truck-mounted drills.

The Markle-Bullers Coal Co., Kittanning, a producer of high-sulfur steam-grade coal, closed its mine because of environmental regulations limiting the emission of sulfur dioxide from the combusion of high-sulfur-content coal.

Westrans Industries, Inc., New York City, in June acquired the privately owned Kristianson & Johnson Coal Co., Lanse, Pa., who mined coal at two separate locations in Clearfield County, and held, on a fee-and-lease basis, 20,000 acres of coal land in four central Pennsylvania counties. Westrans, a natural resources company, was engaged in oil and gas exploration and development, coal production, and natural gas transmission.

Development work was started at United State Steel's new Dilworth mine located near Rice's Landing, 65 miles south of Pittsburgh on the Monongahela River. Mine development was speeded by use of a 17-foot-diameter boring machine to open two slopes to the coal seam. The mine, expected to begin production in late 1974, eventually will produce 4 million tons per year of metallurgical-grade coal. The project will have raw-coal-handling facil-

Table 15.—Pennsylvania: Underground bituminous coal mine data

Coalbed (Geological name)	Thickness (inches)		Mine classification		Production (thousand tons)	Acres mined[1]
	Range	Average	Gaseous	Non-gaseous		
Brookville	42–72	56	--	4	682	203
Freeport	46–78	62	1	1	587	158
Double Freeport	--	84	3	--	1,854	368
Lower Freeport	29–66	42	3	18	2,766	1,098
Thick Freeport	96–108	102	2	--	1,196	195
Upper Freeport	27–66	46	9	16	7,915	2,868
Lower Kittanning	28–78	43	13	24	8,162	3,164
Middle Kittanning	32–48	41	--	4	255	104
Upper Kittanning	32–72	46	3	21	1,598	579
Upper and Lower Kittanning	--	48	1	--	912	317
Miller "B"	--	34	--	1	39	19
Pittsburgh	62–108	75	24	11	22,019	4,893
Redstone	42–48	47	1	2	1	(2)
Sewickley	48–60	55	2	5	1,097	332
Total	--	--	62	107	[3] 49,083	14,298

[1] At 720 tons production per acre-foot.

[2] Less than ½ acre.

[3] Comprises 17,667 from 124 drift mines, 19,080 from 29 slope mines, and 12,336 from 16 shaft mines.

Note: All data in this table were derived from annual reports, published by the Anthracite and Bituminous Division of the Pennsylvania Department of Environmental Resources, that summarize mandatory monthly reports submitted by the bituminous industry.

Table 16.—Pennsylvania: Bituminous coal productivity data, 1971–72

Activity	Production (thousand short tons)		Man-days (thousands) [1]		Productivity		
					Tons per man-day		Percent change
	1971	1972	1971	1972	1971	1972	
Underground:							
Captive (mined and cleaned):							
Mining	21,857	20,943	2,023.6	2,179.0	10.80	9.61	— 11.0
Cleaning and preparation	21,857	20,943	161.6	179.2	135.25	116.87	— 13.6
Total or average	21,857	20,943	2,185.2	2,358.2	10.00	8.88	— 11.2
Noncaptive (mined and cleaned):							
Mining	16,480	23,349	1,323.2	1,852.7	12.45	12.60	+ 1.2
Cleaning and preparation	16,480	23,349	101.1	143.7	163.01	162.48	— .3
Total or average	16,480	23,349	1,424.3	1,996.4	11.57	11.70	+ 1.1
Noncaptive (mined and crushed):							
Mining	6,019	4,792	492.6	441.7	12.22	10.85	— 11.2
Crushing [2]	6,019	4,792	29.5	10.0	204.03	479.20	+134.9
Total or average	6,019	4,792	522.1	451.7	11.53	10.61	— 8.0
Strip:							
Noncaptive (mined and cleaned):							
Mining	10,241	11,061	430.6	444.1	23.78	24.91	+ 4.8
Cleaning and preparation	10,241	11,061	66.5	81.2	154.00	136.22	— 11.6
Total or average	10,241	11,061	497.1	525.3	20.60	21.06	+ 2.2
Noncaptive (mined and crushed):							
Mining	16,415	14,656	690.5	586.7	23.77	24.98	+ 5.1
Crushing [2]	16,415	14,656	80.4	45.4	204.17	322.82	+ 58.1
Total or average	16,415	14,656	770.9	632.1	21.29	23.19	+ 8.9

Auger:							
Noncaptive (mined and cleaned):							
Mining	59	20	1.6	0.5	36.88	40.00	+ 8.5
Cleaning and preparation	59	20	.4	0.2	147.50	100.00	— 32.2
Total or average	59	20	2.0	0.7	29.50	28.57	— 3.2
Noncaptive (mined and crushed):							
Mining	500	519	13.4	12.6	37.31	41.19	+ 10.4
Crushing [2]	500	519	2.5	1.2	200.00	432.50	+116.3
Total or average	500	519	15.9	13.8	31.45	37.61	+ 19.6
Refuse bank recovery:							
Mining	NA	523	NA	* 2.7	NA	193.70	NA
Cleaning and preparation	NA	523	NA	* 3.7	NA	141.35	NA
Total or average	NA	523	NA	6.4	NA	81.72	NA
Total captive and noncaptive:							
Mining	71,571	75,863	4,975.5	5,520.0	14.38	13.74	— 4.5
Cleaning and preparation	48,637	55,896	329.6	408.0	147.56	137.00	— 7.2
Crushing [2]	22,934	19,967	112.4	56.6	204.04	352.77	+ 72.9
Total or average	71,571	75,863	5,417.5	5,984.6	13.21	12.68	— 4.0

* Estimated. NA Not available.

[1] Includes personnel engaged in maintenance, haulage, land surface reclamations, etc.

[2] Includes crushing, sizing, and loading as normally performed at tipples.

Note: All data in this table were derived from annual reports, published by the Anthracite and Bituminous Division of the Pennsylvania Department of Environmental Resources, that summarize mandatory monthly reports submitted by the bituminous industry.

Table 17.—Pennsylvania: Bituminous coal strip and auger mining data, 1972

	Strip-mining operations					Combined strip and auger operations: Strip mining					Combined strip and auger operations: Auger mining			
Pennsylvania district number	Operating companies	Active mining permits	Backfilling operations	Completion of operations	Production (short tons)	Operating companies	Active mining permits	Backfilling operations	Completion of operations	Production (short tons)	Active mining permits	Completion of operations	Production (short tons)	Total production (short tons)
30	20	37	5	--	1,005,683	2	10	--	--	265,048	4	--	53,738	1,324,469
31	6	7	--	--	183,485	4	20	--	3	417,441	11	--	48,101	649,027
32	31	48	3	4	1,326,672	1	11	--	4	701,457	1	--	24,061	2,052,190
33	37	76	16	--	895,380	--	--	--	--	--	--	--	--	895,380
34	34	51	1	5	1,096,838	--	--	--	--	--	--	--	--	1,096,838
35	21	37	--	--	1,129,990	14	37	--	--	1,216,047	16	--	117,989	2,464,026
36	22	74	--	--	4,111,853	--	--	--	--	--	--	--	--	4,111,853
37	15	28	4	8	674,116	--	--	--	--	--	--	--	--	674,116
38	23	40	--	--	843,782	5	21	--	--	430,551	7	--	48,194	1,322,527
39	24	40	--	5	1,136,159	6	23	--	2	493,405	8	2	66,142	1,695,706
40	22	49	2	--	1,131,410	--	--	--	--	--	--	--	--	1,131,410
41	14	24	6	4	510,025	8	21	3	2	563,760	9	1	84,680	1,158,465
42	14	32	6	5	764,592	1	1	--	--	65,001	1	--	7,060	836,653
43	10	30	4	5	852,180	4	11	3	5	220,857	5	4	36,266	1,109,303
44	27	51	1	--	1,411,433	--	--	--	--	--	--	--	--	1,411,433
45	22	63	--	--	2,283,903	2	2	--	--	51,410	2	--	23,316	2,358,629
46	10	15	--	--	314,344	4	13	--	--	258,195	7	--	29,011	601,550
47	12	37	4	9	1,362,023	--	--	--	--	--	--	--	--	1,362,023
Total	[1] 364	[2] 739	51	45	21,033,868	[3] 51	[2] 170	6	16	4,683,172	[4] 71	7	538,558	26,255,598

[1] Includes 298 individual companies, some of which operated in more than 1 district.
[2] Includes backfilling operations and completions.
[3] Includes 46 individual companies, some of which operated in more than 1 district.
[4] Includes completions.

Note: All data shown in this table were derived from information contained in the Annual Report, published by the Anthracite and Bituminous Division of the Pennsylvania Department of Environmental Resources, which summarizes mandatory monthly reports submitted by the bituminous industry.

Table 18.—Pennsylvania: Underground fuel-coal-producing mines permanently abandoned, 1970–72

County and year abandoned	Size range (thousand tons per year)	At time of abandonment			
		Mines closed	Annual production rate, (thousand tons)	Number of employees	Number of mines closed, reason for closure,[1] and production in thousand tons
Allegheny:					
1970	+250	1	299	69	1—f—299.
1970	50	1	12	5	1—c—12.
1972	100–250	1	138	30	1—f—138.
Total	--	3	449	104	1—c—12; 2—f—437.
Armstrong:					
1970	100–250	1	184	26	1—f—184.
1970	50	2	32	22	2—f—32.
1972	50–100	2	161	41	1—e—92; 1—f—69.
Total	--	5	377	89	1—e—92; 4—f—285.
Butler:					
1970	50	1	3	4	1—f—3.
1971	+250	1	276	52	1—d—276.
1972	100–250	1	173	20	1—f—173.
1972	50–100	1	92	22	1—f—92.
Total	--	4	544	98	1—d—276; 3—f—268.
Cambria:					
1970	50	6	12	14	2—b—4; 1—c—3; 2—d—4; 1—f—1.
1971	100–250	1	108	35	1—f—108.
1971	50	8	14	25	3—c—3; 4—d—10; 1—f—1.
Total	--	15	134	74	2—b—4; 4—c—6; 6—d—14; 3—f—110.
Clearfield:					
1970	100–250	1	106	10	1—e—106.
1970	50	1	35	15	1—e—35.
1971	50	1	7	17	1—e—7.
1972	+250	1	300	24	1—f—300.
1972	50	1	46	22	1—d—46.
Total	--	5	494	88	1—d—46; 3—e—148; 1—f—300.
Elk: 1970	50	2	29	9	2—d—29.
Indiana:					
1970	100–250	1	205	36	1—f—205.
1970	100–250	1	200	24	1—f—200.
1971	100–250	1	165	70	1—b—165.
1971	100–250	1	228	24	1—f—225.
1971	50–100	1	58	12	1—e—58.
1971	50	2	1	28	2—f—4.
1972	50–100	1	70	11	1—a—70.
1972	50	2	20	20	1—b—12; 1—d—8.
Total	--	10	947	225	1—a—70; 2—b—177; 1—d—8; 1—e—58; 5—f—684.
Jefferson:					
1970	100-250	1	149	41	1—f—149.
1970	50	1	6	3	1—f—6.
1971	100–250	1	161	43	1—e—161.
1971	50	1	1	3	1—f—1.
1972	100–250	1	120	50	1—e—120.
Total	--	5	437	140	2—e—281; 3—f—156.
Somerset:					
1970	50	5	27	11	3—a—13; 2—d—14.
1971	100–250	1	140	13	1—f—140.
1971	50	3	28	36	1—a—2; 2—f—26.
1972	50	2	46	22	1—d—39; 1—f—7.
Total	--	11	241	82	4—a—15; 3—d—53; 4—f—173.
Washington:					
1972	50	1	46	7	1—f—46.
Westmoreland:					
1970	50	1	5	2	1—d—5.

See footnotes at end of table.

Table 18.—Pennsylvania: Underground fuel-coal-producing mines permanently abandoned, 1970–72—Continued

County and year abandoned	Size range (thousand tons per year)	At time of abandonment			Number of mines closed, reason for closure,[1] and production in thousand tons
		Mines closed	Annual production rate, (thousand tons)	Number of employees	
State:					
1970	+250	1	299	69	1—f—299.
1970	100–250	5	844	137	5—f—844.
1970	50–100	--	--	--	
1970	50	20	161	85	4—a—20; 2—b—4; 2—c—15; 6—d—45; 1—e—35; 5—f—42.
Subtotal	--	26	1,304	291	4—a—20; 2—b—4; 2—c—15; 6—d—45; 1—e—35; 11—f—1,185
1971	+250	1	276	52	1—d—276.
1971	100–250	5	802	185	1—b—165; 1—e—161; 3—f—476.
1971	50–100	1	58	12	1—e—58.
1971	50	15	51	109	1—a—2; 3—c—3; 4—d—10; 1—e—7; 6—f—29.
Subtotal	--	22	1,187	358	1—a—2; 1—b—165; 3—c—3; 5—d—286; 3—e—226; 9—f—505.
1972	+250	1	300	24	1—f—300.
1972	100–250	3	431	100	1—e—120; 2—f—311.
1972	50–100	4	323	74	1—a—70; 1—e—92; 2—f—161.
1972	50	6	158	71	1—b—12; 3—d—93; 2—f—53.
Subtotal	--	14	1,212	269	1—a—70; 1—b—12; 3—d—93; 2—e—212; 7—f—825.
Grand total	--	62	3,703	918	6—a—92; 4—b—181; 5—c—18; 14—d—424; 6—e—472; 27—f—2,515.

[1] a—1969 Coal Mine Health and Safety Act.
b—Market conditions or inferior product.
c—Personnel problems.
d—Economic conditions.
e—Adverse mining conditions.
f—Mine worked out.

ities, a river harbor, barge-loading equipment, and service and supply buildings. A barge unloader and a raw coal conveyor belt system will also be built at United States Steel's Robena mine preparation plant 12 miles from the Dilworth mine.

Jones & Laughlin Steel Corp. (J & L) started a $11 million program to substantially increase production and to extend the life of its Vesta No. 5 mining complex at Vestaburg, Washington County. Mining operations will be extended into a new coal reserve, a modern conveyor belt system will be built, at least one longwall mining system will be installed, and a new portal and surface facilities will be located near Scenery Hill. Coal production will be increased from the current 2,500 tons per day to about 5,200 tons per day. As the complex is further developed, production in 1980 should be about 10,000 tons per day.

New bituminous coal preparation facilities contracted in 1972 for Pennsylvania mines included a complete 20,000-ton-capacity storage and reclaim facility at Barnesboro; 200-ton-per-hour-capacity cleaning equipment at the No. 6 plant of the Benjamin Coal Co.; a new 1,000-ton-per-hour cleaning plant scheduled for completion in late 1973 for Duquesne's Warwick mine, Greensboro, Greene County; a $1.8 million modernization of the Mathies Coal Co. preparation plant near New Eagle; 250-ton-per-hour-capacity heavy media equipment for Penn-Allegheny Coal Co., Millersville; a 300-ton-per-hour-capacity storage and reclaim facility for Penn-Allegheny at Tarentum; a heavy media separator, pumps, feeders, and screens for PBC Coals, Inc., Somerset County; and a complete preparation and storage facility including a Williams & Green feeder, a rotary breaker, and a radial 400-ton-per-hour stacker for the Fisher Mining Co., Williamsport.

To obtain information in establishing emission standards for coal cleaning plants, using air tables, York Research Corp. conducted tests under EPA supervision at the Florence Mining Co. plant in Indiana County.

At a September 7 meeting in Pittsburgh sponsored by The Keystone Coal Producers Association (KCPA) and DER, about 100 deep mine operators expressed strong opposition to any plan requiring the return of coal waste underground because such disposal would be expensive, dangerous, and unnecessary. One operator claimed that underground disposal of coal waste would increase the cost of salable coal by $1.25 per ton. Other operators stated that the use of 150 to 200 tons of fly ash per surface acre of coal waste dumps would make the surface suitable for establishing cover vegetation.

Aerial surveys, followed by surface inspections by Bureau of Mines personnel, were made at 10 coal refuse dams in western Pennsylvania. It was concluded that none of the dams was in immediate danger of collapsing, barring extreme weather conditions.

The DER rejected the application of ERG, Inc., New Eagle, Washington County, to strip-mine bituminous coal adjacent to Mingo Creek Park. The denial was important because the decision was based on the Natural Resources and Public Estate Amendment to the Pennsylvania Constitution even though the application fulfilled the requirements of the Surface Mining and Clean Streams Law. DER also denied the application of Compass Coal Co., Inc., to strip-mine bituminous coal on the watershed of the public water supply for the city of DuBois.

The U.S. Third Circuit Court of Appeals, Philadelphia, in November reversed a ruling of the U.S. District Court, Pittsburgh, that enjoined miners from striking United States Steel's Maple Creek mine in Washington County. United States Steel previously had argued successfully in the U.S. District Court that the walkout over an alleged safety hazard violated the soft coal wage agreement of 1968. More than 5,000 miners at 10 establishments of four coal companies in southwestern Pennsylvania were idle in late June despite a U.S. District Court order against picketing at some mines following protests based on the suspension of three men for alleged safety violations. Reportedly, the estimated value of lost production was $1.2 million at a Bethlehem Mines Corp. mine, $150,000 at the Clyde mine of the Republic Steel Corp., and $250,000 per day at United States Steel mines. Coal production at these mines was partially resumed June 28.

A strike that began with 55 coal strip mine workers of Penn-Pocahontas Coal Co., Garrett, Somerset County, eventually involved 1,500 employees at The Bird Coal Co., Somerset County, Bethlehem's Nanty Glo Mine, Indiana County, and the North American Coal Corp.'s mining complex at New Florence, Westmoreland County. Reportedly, the walkout at Penn-Pocahontas followed the Federal Pay Board's rejection of a wage contract between the company and the UMWA that increased wages in conformance with the master soft coal agreement.

In western Pennsylvania, 4,555 acres of strip-mined bituminous coal land were planted with 4.75 million trees, all except 300,000 of which came from State tree nurseries. About 200 acres were planted with both trees and wildlife shrubs. Permanent grasses were planted on 3,825 acres on which an average of 300 pounds of 10–10–10 grade commercial fertilizer and 2 tons of screened or pulverized limestone was applied per acre.

Mine water treatment methods at Duquesne's Warwick Mine No. 2 and total costs per 1,000 gallons treated were reported.[9]

The Commonwealth Court in January ruled that the Pittsburgh Coal Co. and the Harmar Coal Co. were not responsible for treating mine drainage originating in adjacent abandoned mines. The DER contended that the separate decisions would harm its mine drainage program. The Court agreed to review both cases.

The DER signed three agreements in April for sealing and leveling the Wildwood mine refuse bank adjacent to North Park beginning May 15. The operator and owner of the mine, Butler Consolidated Coal Co., furnished $85,000, and a Wildwood Center development firm agreed to contribute $15,000 for the project. A nine-hole golf course will be located on the restored area.

The Leechburg Mining Co., Armstrong County, entered into a consent agreement June 27 with DER's Environmental Hearing Board to take corrective actions satisfying air and water pollution regulations. In December, DER filed an injunction suit claiming violations of its environmental regulations and asking that the company post a $1,250,000 bond to insure compliance. The Commonwealth Court scheduled a review of the charges January 15, 1973.

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[9] Draper, J. C., and R. E. McHugh. Warwick Mine No. 2 Water Treatment Min. Cong. J., v. 58, No. 8, August 1972, pp. 24–28.

Five grades of coal were converted to nonpolluting oils by the Bureau of Mines Energy Research Center in Bruceton. The Center was building a 50-pound-per-hour pilot plant to replace 5- to 10-pound-per-hour equipment initially used in developing a coal liquefaction and hydrodesulfurization process. The Center held a meeting October 6 to review its research on fuels and pollution control and to exchange ideas with academic and industrial energy technologists.

Groundbreaking ceremonies were held July 27 at Homer City for a pilot plant to convert different types of coal into pipeline-quality gas. The plant, the first of its type, is a joint venture of the Office of Coal Research (OCR) of the Department of the Interior and BCR. Two-thirds of the plant's $19 million cost will be funded by OCR and one-third by AGA. The plant's 36-acre site was donated by the Indiana County Development Association. In the BCR-developed BI-GAS process, pulverized coal is contacted with oxygen and steam at high temperature and pressure, and the resulting gases are freed of acidic gases before methanation. The pilot plant is designed to produce 100,000 standard cubic feet per hour of pipeline-quality gas from 5 tons of coal. A commercial plant would require 12,000 tons per day of coal to produce 250 million standard cubic feet per day (scfd). BCR selected Stearns-Roger, Inc., Denver, Colo., to engineer, build, and operate the pilot plant.

A coal gasification pilot plant for the Bureau of Mines Synthane process was announced. The $9.7 million plant will be built at Bruceton by the Rust Engineering Div., Wheelabrator-Frye Inc. The plant, due for completion in August 1974, will provide for the testing of alternate designs.

Three contracts were developed by the DER's Bureau of Occupational Health (BOH) with the National Institute for Occupational Safety & Health (NIOSH) of the Department of Health, Education, and Welfare. They were the asbestos-beryllium contract for an in-depth study of these hazards, the coal handlers' study for the environmental and medical evaluation of workers' exposures to coal dust in locations other than in coal mines, and a contract to train Federal plant inspectors for the National Surveillance Network Program within NIOSH. The Federal $118,432 involvement benefited DER monetarily and was an adjunct to BOH personnel.

In 1972, the DER's Deep Mine Safety (DMS) function advanced from the division to bureau level when DMS was made responsible for safety not only in coal mines but in metal and nonmetal mines as well. The DMS inspection force was increased 20% following the reorganization of 24 underground bituminous mining districts into 27 districts. DMS reevaluated the organization of anthracite districts to respond to changes in mining operations.

Conflicts between DER and Federal safety requirements were compared by the Bureau of Mines Deputy Director of Health and Safety in a June session in Pittsburgh. Differences included the use of flame safety lamps to detect methane instead of an electronic detector to measure concentrations below 0.25 volume-percent, the level that cannot be exceeded under Federal law; cleanup procedures to reduce the consumption of rock dust; and the use of conveyor belt entries for ventilation purposes, a practice banned by the Bureau of Mines. It was clearly stated that Federal requirements would take precedence.

In the 1972 National Safety Competition sponsored by the American Mining Congress and the Bureau of Mines, the top winner in the underground coal group was the Robena No. 1 mine, Frick District, United States Steel Corp., Carmichaels, Pa., because of 740,496 man-hours worked without a disabling injury.

According to the March 1973 Keystone Coal Industry Manual, Pennsylvania had 13 of the country's 128 bituminous coal mines that produced more than 1 million tons apiece. The 13 mines in Pennsylvania produced 9.7% of the 250.27-million-ton production from the 128 mines. Data in table 19 shows the production and national rank of the 13 mines.

Coke.—Pennsylvania ranked first in oven-coke production with 27% of the U.S. production. Nine companies operated 12 oven-coke plants, of which three were classified as merchant and 10 as furnace. Total coal received by the 12 plants was 23,018,000 tons and comprised 2,292,000 tons from

Table 19.—Pennsylvania: Plus-million-ton-production bituminous coal mines, 1972

Company	Name of mine	Type of Mine	Production (thousand tons)	National rank [1]
United States Steel Corp	Robena	Captive, deep	3,008	18
Florence Mining Co	No. 1	Deep	2,327	28
C & K Coal Co	Fox	Strip	2,300	30
Mathies Coal Co	Mathies	Deep	2,205	32
United States Steel Corp	Maple Creek	Captive, deep	2,062	38
Rochester and Pittsburgh Coal Co	Jane	Deep	1,999	40
Pittsburgh Coal Div., Consolidation Coal Co.	Montour No. 4	Deep	1,935	45
Duquesne Light Co	Warwick	Captive, deep	1,714	56
Gateway Coal Co	Gateway	Captive, deep	1,599	63
Helvetia Coal Co	Lucerne No. 6	Deep	1,365	87
Bethlehem Mines Corp	Marianna No. 58	Captive, deep	1,354	88
Do	Somerset No. 60	Captive, deep	1,332	90
Do	Ellsworth No. 51	Captive, deep	1,088	116

[1] Based on production.

Kentucky mines, 11,904,000 from Pennsylvania mines, 752,000 from Virginia mines, and 8,070,000 from West Virginia mines. The 12 plants carbonized 22,764,000 tons of bituminous coal and 122,000 tons of anthracite to produce 15,869,000 tons of breeze-free metallurgical coke of which 97.7% was blast furnace grade valued at $37.29 (average) per ton. The 13 plants also produced 777,000 tons of coke breeze, and byproducts comprising fuel gas, nitrogenous compounds, tar, naphthalene, pitch, and crude light oil and its derivatives.

The number of operating coke oven batteries in Pennsylvania and the number of ovens in each battery at yearend were—

Plants	*Batteries*	*Ovens*
Jones & Laughlin—Aliquippa	8	271
Jones & Laughlin—Pittsburgh	4	315
Bethlehem Steel—Bethlehem	6	372
Bethlehem Steel—Johnstown	8	228
Bethlehem Steel—Johnston (Rosedale)	1	88
Crucible Steel—Midland	3	113
United States Steel—Clairton	20	1,375
United States Steel—Morrisville	2	174
Interlake—Erie	2	58
Wheeling—Pittsburgh Steel—Moneseen	2	93
Shenango—Pittsburgh	3	105
Alan Wood—Conshohocken	2	110
Philadelphia Coke—Philadelphia	1	74
Total	52	3,376

Four beehive coke plants operated by four companies in Armstrong, Fayette and Indiana Counties carbonized 297,000 tons of bituminous coal, all from Pennsylvania mines, and produced 160,000 tons of coke, 99.9% of which was blast furnace grade. The average coke yield for the four plants was 53.9 weight %.

Coke exports through Philadelphia totaled 81,677 short tons compared with 154,556 tons in 1971.

According to the Eastern Gas and Fuel Associates Annual Report, demand for foundry coke remained strong throughout 1972, but deliveries by the firm's merchant coke plant in Philadelphia were less than in 1971 because of wind damage to a conveyor-system gallery, which resulted in limited operations for about eight weeks early in the year. Total production was 266,000 tons of foundry coke and 57,000 tons of smaller sizes. Exports of coke were restricted in order to satisfy domestic demands.

Effective with December 18 shipments, Shenango, Inc., increased its price for foundry coke $2.50 to $56.75 per net ton f.o.b. ovens at Neville Island. The rising cost was attributed to higher prices for coking coal, increased labor rates, and compliance with environmental control standards.

The Bortz Coal Co., an operation of beehive coke ovens in Smithfield, Fayette County, in late June lost its appeal to overturn a pollution citation issued by DER. The company was ordered to install pollution control devices by September 1 or face court action leading to an injunction.

At yearend 1970, J & L operated five diesel-powered towboats and about 225 barges to transport more than 5 million tons of coal per year from its mines in Washington and Greene Counties to its coke plants in Pittsburgh and Aliquippa.

Natural Gas Liquids.—Proved reserves at yearend totaled 735,000 42-gallon barrels.[10]

Capacity of the two natural gas processing plants, operated by the Mars Co., as of January 1, 1972, was 8 million cubic feet per day. In 1971, daily production from these two plants totaled 6,300 gallons comprising 3,000 gallons of propane, 1,200 gallons of butane, and 2,100 gallons of debutanized natural gasoline.[11]

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[10] Oil and Gas Journal. U.S. Reserves Skid Again: Both Oil and Gas Down Sharply. V. 71, No. 13, Mar. 26, 1973, p. 54.

Compared with 1971, the quantity of natural gas liquids produced was 35.9% greater and its total value was 33.9% greater.

Peat.—At least 90% of the peat found in Pennsylvania occurs in areas north of the glacial terminal moraine.

Nine operations in six counties reported a total production of 23,136 short tons, 40.5% less than in 1971. Of the total production, 1,000 tons was shredded and kiln dried, 1,075 tons was kiln dried only, and 21,061 tons was shredded only. Luzerne County was the leading producer, followed by Erie County. Other producing counties were Columbia, Lackawanna, Lawrence, and Monroe.

Sales totaling 22,416 tons, at an average value of $14.28 per ton, were 30.6% less and averaged $2.22 per ton more than in 1971. Sales of bulk peat for general soil improvement totaled 15,473 tons and averaged $13.40 per ton. Total sales and average value by type was as follows: 4,295 tons of moss peat at $14.98 per ton, 16,661 tons of reed-sedge peat at $13.64 per ton, and 1,460 tons of humus at $19.71 per ton.

Petroleum and Natural Gas.—Crude petroleum production was 10% less than that in 1971. The Oil and Gas Division, Pennsylvania Bureau of Topographic and Geologic Survey, reported that Pennsylvania-grade crude production totaled 3.36 million barrels valued at $16.16 million, with an additional 78,000 barrels, 13,000 more than in 1971, of Corning-grade crude oil, valued at $255,400, produced in Crawford County from the Medina (Lower Silurian) Sandstone. The number of producing wells decreased from 34,029 in 1971 to 32,596 at yearend 1972. Estimated proved recoverable reserves of crude oil at yearend totaled 36.7 million barrels, a decrease of 10.3 million barrels from that of yearend 1971. Natural gas production totaled approximately 74 billion cubic feet (Bcf), a decrease of 3% from that of 1971. A total of 61.8 Bcf of gas was produced from shallow (upper Devonian or younger) reservoirs, while production from deep (Middle Devonian or older) reservoirs totaled 12.1 Bcf. The estimated number of producing gas wells remained about the same as in 1971 at 16,600. Estimated proved reserves of natural gas totaled 1,407 Bcf, including 607 Bcf in storage at yearend. This was an increase of 11 Bcf from that of 1971.

The Oil and Gas Division reported 948 new wells being drilled and 34 wells being deepened during 1972. Of these, 517 were oil wells, 284 gas, 16 oil and gas, 55 service, 13 gas storage, and 63 dry holes. Of the old wells drilled deeper, 13 were gas, one oil, 13 gas storage, and seven dry. Total footage of all wells (982) drilled was 1,922,319. Of 901 well completions (excluding service and gas storage wells) 66 were exploratory (35% successful) and 835 were development (98% successful), an increase of 77% and 3% respectively. Deep drilling (Middle Devonian or older) decreased from 106 wells in 1971 to 63 wells in 1972 including 12 wells drilled deeper. As in 1971, the majority of deep development drilling was in the Medina gas area of Crawford County where eight gas wells, four oil and gas wells, and one dry hole were drilled in the Indian Springs field. The two wells producing oil had initial productions of 40 barrels per day of Corning grade crude. Most of the activity in shallow gas fields was in the following counties: Indiana 159 gas wells; Armstrong 24, and Jefferson, 24. The majority of the shallow oil development was carried on in the following counties: Venango, 211 wells producing from the Red Valley and Venango Second sandstones; Warren, 127 oil wells with Glade sand production; Forest, 108 wells with production from the Red Valley and Venango Second sandstones; and McKean, 74 wells producing from the Bradford and associated sandstones. Seismic activity was at an alltime high during the year with most of it being vibroseis. Seismic crews logged 263 crew-weeks, costing operators over $4 million during 1972, compared with 147 crew-weeks during 1971, an increase of 79%. The seismic surveys were made in Armstrong, Beaver, Bedford, Blair, Bradford, Bucks, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Elk, Erie, Fayette, Forest, Fulton, Greene, Indiana, Jefferson, Lycoming, McKean, Pike, Potter, Somerset, Sullivan, Susquehanna, Tioga, and Washington Counties, 29 of the 67 counties in the State.

Two expanded Maraflood projects con-

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[11] Oil and Gas Journal. 1972 Survey of Gas-Processing Plants. V. 70, No. 28, July 10, 1972, pp. 91, 112.

Table 20.—Pennsylvania: Oil and gas well drilling completions, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Allegheny	--	1	1	--	--	--	2	7,369
Armstrong	--	25	2	--	1	--	28	93,883
Beaver	--	1	--	--	--	--	1	1,017
Bedford	--	--	--	--	--	3	3	15,235
Bradford	--	--	--	--	--	1	1	5,290
Butler	2	1	--	--	--	--	3	5,496
Cambria	--	1	--	--	--	3	4	26,971
Cameron	--	2	--	--	1	7	10	55,416
Clarion	2	4	--	--	--	3	9	22,013
Clearfield	--	10	--	--	4	--	14	45,975
Crawford	4	8	1	--	--	--	13	45,731
Elk	3	1	--	--	2	2	8	25,571
Erie	--	4	--	--	--	2	6	18,280
Fayette	--	5	1	--	--	--	6	25,984
Forest	108	3	--	--	--	1	112	99,923
Greene	--	2	2	--	--	--	4	7,870
Indiana	--	159	5	--	8	3	175	596,378
Jefferson	--	24	--	--	--	1	25	80,597
Luzerne	--	--	--	--	--	1	1	4,595
McKean	74	3	8	1	2	2	90	167,092
Mercer	--	1	--	--	--	4	5	21,387
Pike	--	--	--	--	--	1	1	13,910
Potter	--	1	--	--	1	1	3	13,922
Somerset	--	--	--	--	--	1	1	4,904
Tioga	--	--	--	--	--	2	2	12,508
Venango	211	2	4	--	--	4	221	181,184
Warren	127	1	3	2	--	--	133	125,054
Washington	--	1	--	--	--	--	1	2,215
Wayne	--	--	--	--	--	1	1	12,250
Westmoreland	--	17	--	--	1	--	18	66,190
Total	531	277	27	3	20	43	901	1,804,210

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

tinued operation, one in McKean County in the Third Bradford sand, and the other in Venango County in the Venango First sand.

The wellhead price of new natural gas increased to 45 cents per 1,000 cubic feet, 15 cents more than a year earlier. Effective December 1, the wellhead price of Pennsylvania-grade crude oil increased 60 cents per barrel. This crude was priced at $5.48 per barrel in the Bradford district, $5.20 in the Middle district, and $4.77 in the Southwestern district. Corning-grade crude oil in Erie and Crawford Counties advanced to $3.82 per barrel. The basic Bradford district price of $5.48 was the highest since 1920 when the price was $5.97 per barrel. The next highest price prior to 1920 was $5.64 in 1869. Although the 60 cent price increase affected less than 1% of the country's 9.5-million-barrel-per-day crude production, the increase offered to Pennsylvania-grade producers, incentive to find new reserves.

According to the American Gas Association, Pennsylvania, as of December 31, 1971, had 66 dry gas reservoirs, rated at 752.7 bcf capacity, equal to 13.9% of the total U.S. gas reservoir capacity. The reservoirs were serviced by 2,135 wells, and had stored in them 593.8 bcf (at 14.73 psia and 60° F), or 16.9% of the total gas in all U.S. gas storage reservoirs.

Pennsylvania gas storage reservoirs received 303.3 bcf., delivered 284.5 bcf, and attained a net gain in storage of 18.8 bcf during 1971.

The Pennsylvania Game Commission did not lease any additional acreage in 1972 for exploration or development of oil and gas. At the end of 1972 the Commission had 28 active leases totaling 11,737 acres. Forty-one wells were producing on the 28 leases, 6 were acquired on new leases with land purchased, and one well was plugged and abandoned. No wells were drilled on Commission lands during the year.

Through competitive bidding, 80,458 acres of State forest or park lands were leased during 1972. The total bonus or first-year rental received for these tracts was $691,094. The average of all sales was $8.59 per acre. After the first year, the rental was $1.00 per acre per year with royalties equal to one-eighth or more of all production.

Income derived from oil and gas exploration and development on State forest and park lands totaled $1,011,494, of which royalty payments amounted to $129,225 for

1,281,141 thousand cubic feet and $882,269 for tract rentals, gas storage, rights-of-way, etc. At year end, 234,066 acres (including 59,109 acres in gas storage) of State forest and park lands were under lease for oil and gas exploration and development.

The Dowdle Oil Corp., Midland, Tex., in September completed two initial wells of its planned multiwell natural gas drilling program on 2,712 acres of oil and gas leases in Indiana County. The firm planned to drill an additional 48 wells on this acreage during the remainder of 1972 and in 1973. The No. 1 Bence well produced 1,895,000 cubic feet per day from four Devonian Age zones between 2,468 and 3,270 feet. The No. 1 Musser well produced 550,000 cubic feet per day between 2,460 and 3,310 feet in the same zones. Gas from both wells went to Peoples Natural Gas Co., of Pittsburgh, under long-term contract at an initial price of 45 cents per thousand cubic feet. Dowdle's fourth well, the No. 2 Warren, after completion in December produced 2 million cubic feet per day from four Devonian Age zones between 2,630 and 3,456 feet.

The Columbia Gas Transmission Corp. paid Trend Exploration, Ltd., $2 million for seismographic data. Columbia also leased 200,000 acres in northern Pennsylvania and southern New York.

Peoples Natural Gas Co. announced plans in January to spend $17.5 million to increase the supply of natural gas in western counties during 1972. The drilling of 43 new wells was estimated to cost $1.8 million, and $1.7 million was allocated to construct gathering lines from shallow wells in the eastern sections of the firm's service area. The cost of cleaning out and fracturing 19 existing wells was estimated as $364,000. The firm completed a 33-mile gathering line in Indiana County.

Columbia Gas Systems of Pennsylvania, in compliance with a February 1 order from the Public Utilities Commission (PUC), banned all new gas sales to residential, commercial, and industrial customers. The firm serviced 331,000 customers in 22 western counties. Peoples Natural Gas Co. and Equitable Gas Co. also turned away new customers and curtailed supplies to PPG Industries plants in Creighton and Ford City and to the Jeanette plant of ASG Industries.

The PUC on June 15 conditionally approved a 5% price increase applicable to 280,000 Equitable Gas Co. customers in eight western counties. Spokesman for United State Steel and J & L told the PUC in July that if the fuel-price increase was granted, it would cost United States Steel $500,000 and J & L $250,000 per year.

The Federal Power Commission (FPC) approved an emergency arrangement in September that allowed five major gas pipeline companies to deliver up to an additional 1.1 bcf of gas until August 1973 to the Pennsylvania Gas & Water Co., to meet a critical shortage in the flood-stricken area of Wilkes-Barre.

The FPC in August authorized Consolidated Gas Supply Corp., Clarksburg, W. Va., and Texas Eastern Transmission Corp., Houston, Tex., to build facilities costing $8.8 million at the jointly owned underground Oakford gas storage field in Westmoreland County. Included was a 12,700-horsepower (hp) compressor station that will be used to increase storage capacity by 10 bcf to 70 bcf.

Liquefied natural gas (LNG) facilities in operation included: Philadelphia Electric Company's 6.6-million-cubic-foot-per-day liquefaction plant and a storage tank with a capacity of 348,000 barrels of liquid, equivalent to 1.2 bcf of gas, and the Philadelphia Gas Work's (PGW) 16-million-cubic foot-per-day liquefaction plant 1.2 million-barrel liquid-storage capacity, equivalent to 4.0 bcf of gas.

Airco Cryoplants was constructing a LNG plant for UGI in Reading. The plant will use an expander-nitrogen cycle and was to be operable in 1973. UGI also completed, in Reading in the winter of 1971–72, a 73,000-barrel, 250-million-cubic-foot (mmcf) gas-equivalent, double-wall storage vessel constructed using 9% nickel steel. This vessel, used as a peakshaving facility, was supplied by PGW and the Boston Gas Co., Boston, Mass.

The status of substitute natural gas (SNG) reforming plants in Pennsylvania as of December 1972 was as follows. The Apco Oil Corp. proposed a 125-million-cubic-feet-per-day (mmcfd) capacity, $30 million plant to be operative at an eastern county site by 1974. The Lurgi process will be used to reform 28,000 barrels per day of naphtha. The Philadelphia Electric Company announced four, 125-MMcfd plants to reform naphtha. The first plant would be operative in 1974, followed by one plant in every fourth year

Underground gas storage operations in 1972 are shown in the following tabulation:

Company	Number of fields	Number of wells	Miles of storage lines	Storage compressor stations	
				No.	Hp
Columbia Gas of Pennsylvania, Inc	1	8	6	1	900
Duquesne Natural Gas Co	1	5	--	1	165
Equitable Gas Co	15	235	129	7	13,500
Kane Gas Light & Heat Co	1	21	10	1	60
North Penn Gas Co[1]	2	21	18	1	4,995
Pennsylvania Gas Co	8	333	108	4	9,570
Peoples Natural Gas Co[2]	8	87	32	7	10,320
Saxonburg Heat & Light Co	3	6	NA	NA	NA

NA Not available.
[1] Jointly owned.
[2] One field under development.

Source: Pipeline and Gas Journal. V. 199, No. 14, December 1972, pp. 33–36.

thereafter. The plants would be built in the Philadelphia area, and their total cost would be $150 million. PGW planned a $35 million, 100-MMcfd plant to reform naphtha in Philadelphia. The Transco Energy Co. (Transcontinental Gas Pipe Line Corp.) announced a 250-MMcfd, $85 million, Lurgi process plant to reform 53,500 barrels per day of naphtha and 4,200 barrels per day of propane. One-half of the naphtha and all of the propane will come from domestic sources. The plant will be located at Twin Oaks near Marcus Hook and will be operative in 1974 or 1975. The Howard Oil Refining Co. planned a 177-MMcfd SNG plant in Philadelphia.

Pennsylvania with a 4811.1-million-gallon consumption, ranked sixth in the top 25 gasoline-consuming States. The 10 leading companies marketing gasoline in Pennsylvania and their percentage of the total Pennsylvania market was as follows: Arco, 15.82; Exxon, 10.65; Sun, 10.19; Gulf, 8.19; Texaco, 7.94; Mobil, 7.61; American, 5.98; Phillips, 2.06; BP Oil, 1.30; and Getty, 1.28.[13]

The lubricating oil and wax producing capacities of Pennsylvania petroleum refineries as of January 1, 1973, as compiled by the National Petroleum Refiners Association, are shown in table 21, together with the manufacturing processes used for lubricating oil production. Collectively the seven lubricating oil producers in western Pennsylvania accounted for approximately six % of U.S. production.

As of January 1, 1972, seven refineries in western Pennsylvania had a total capacity to process 34,820 barrels per day of Pennsylvania-grade crude oil. Three of the seven refineries, having a 9,000-barrel-per-day total-feed capacity, also produced solid lubricants and waxes. Their daily liquid-fuels-producing capacity is unknown. Four of the seven refineries had a total crude feed capacity of 25,820 barrels per day, and their total operating and shutdown capacity to handle feedstocks for producing gasoline and other liquid fuels totaled 11,252 barrels per calendar day (bpcd). Their total operating capacity for producing gasoline and other liquid fuels totaled 7,675 bpcd, and their shutdown capacity could have produced 2,252 bpcd. These four refineries produced lubricants and waxes as their principal products.

Four major operating refineries near the Delaware River that solely processed interstate and foreign crude oils had capacity, all of which was in use as of January 1, 1972, to refine 591,300 barrels per calendar day. The four refineries had capacity to produce 317,660 barrels per calendar day of gasoline and other liquid fuel distillates. However, 6.5% of this capacity was shutdown. The daily feedstock charge and production of distillate fuels, in barrels by process was as follows:

Type of process	Charge capacity, operating and idle	Distillate fuel production capacity	
		Operating	Idle
Alkylation	42,600	26,200	--
Catalytic cracking	228,800	119,200	13,500
Catalytic refining	164,500	139,860	--
Hydrocracking	28,000	11,000	--
Thermal cracking	10,900	700	--
Thermal refining	12,000	--	7,200
Total	486,800	296,960	20,700

Pennzoil's new hydrogen plant and hydrotreater unit at the Oil City refinery were put onstream January 1. The lubricating-oil-hydrotreating process was developed by Gulf Research & Development Co. The

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[13] Oil and Gas Journal. The Big Marketers in the Top 25 Gasoline-Consuming States. V. 71, No. 20, May 14, 1973, p. 80.

Table 21.—Pennsylvania: Lubricating oil and wax capacities of petroleum refineries as of January 1, 1973, by company and refinery location

(In barrels per calendar day)

Company	Ashland Oil Inc., Valvoline Oil Co.	Pennsylvania Refinery Co.	Pennzoil Co.		Quaker State Oil Refining Corp.		Wetco Chemical Corp., Bradford Division	Sun Oil Co.	
	Freedom	Karns City	Reno	Rouseville	Emlenton	Farmers Valley	Bradford	Marcus Hook	Total
Finished lubricating oil, capacity	1,000	800	500	8,175	1,700	2,500	1,800	16,000	26,975
Finished wax capacity [1]	X	X	X	X	X	X	X	X	
Unfinished wax capacity [2]				[3] X	X	X	X	X	
Processes employed:									
Vacuum distillation							X		
MEK benzol dewax	X	X	X						
Propane dewax					X	X		X	
Centrifuge							X		
Furfural extraction								X	
Phenol extraction	X	X	X	X	X	X	X		
Duo-Sol extraction		X		X					
Bauxite percolation								[3] X	
Hydrotreating [4]	100		36	492	300	350	400	900	2,578
Hydrofinishing [5]			56	118	600	500	800		2,069

[1] Includes full refined, crude scale, and microwaxes.
[2] Includes semifinished, slack waxes (paraffin), and petrolatums.
[3] Uses toluene instead of benzol.
[4] High-pressure hydrogen processing including low to high-severity cracking.
[5] Low-temperature, low pressure catalytic finishing with hydrogen.

Bradford Petroleum Div., Witco Chemical Corp., used its staff to increase the crude capacity of its Bradford refinery by 7,500 barrels per day. The Quaker State Oil Refinery Corp.'s 6,500-bpcd refinery at Farmers Valley was closed July 27 when collective bargaining negotiations reached a stalemate. Normal operations resumed August 10, and negotiations were continued.

The United Refining Co.'s Warren refinery processed 25,000 bpcd of interstate and foreign crude oils. This refinery's capacity was 18,700 barrels per day of distillate charge, and an output capacity, none of which was idle, to produce 12,900 barrels per day of gasoline and other liquid fuels. The Warren refinery also produced asphalt. Two Merox units, designed and licensed by Universal Oil Products Co. (UOP), were installed to treat light fluid catalytic cracking (FCC) gasoline and heavy FCC gasoline.

The National Transit Co. asked the PUC for approval to increase by $400,000 annually its charges for the pipeline transportation of petroleum products effective March 21. The firm operated two, high-pressure, 6-inch lines between the West Virginia border and Pennsylvania refineries at Bradford, Emlenton, Karns City, and Rouseville. The additional revenue was needed to improve the pipelines and to begin antipollution safeguards ordered by DER. A break in one of the pipelines on April 12 released between 800 and 1,000 gallons of crude oil into a Venango County stream. Most of the oil was recovered from the stream before it entered the Allegheny River.

The Howard Oil Refining Co. planned a $200 million, 150,000-barrel-per-day (bpd) refinery to be in operation in Philadelphia in 1974.

The Atlantic Richfield Co. (ARCO) awarded the Fluor Corp. a contract in March to engineer, procure, and construct process units of a multi-million-dollar modernization program at its Philadelphia refinery. In addition to a major revision of the existing 130,000-bpd capacity crude unit, the project will add a 57,000-bpd-capacity vacuum unit, a 41,000-bpd-capacity hydrodesulfurizer unit, and a 20,000-bpd-capacity gas-oil hydrodesulfurizer unit. A 30,000-bpd-capacity high-octane-gasoline Magnaformer started operation early in 1972. In the 1965–75 period the Philadelphia refinery was expected to obtain a 75% reduction in hydrocarbon emissions from the 45.3-ton-per-day level in 1965, and sulfur dioxide emission should be reduced 91% from the 83.1-ton-per-day (tpd) level in 1965.[13]

Gulf's Philadelphia refinery in December completed a small plant that used the J. F. Pritchard & Co. process to reduce sulfur compounds in the refinery's Claus-plant tail gas to less than 300 parts per million (ppm) sulfur dioxide eqiuvalent, equal to 60% of Philadelphia County's proposed standard. The Claus unit will recover 46 long tons per day of sulfur, and the Pritchard process will recover an additional 1.5 long tons per day. A $6 million, 10-million-gallon-per-day (MMgpd) wastewaters treatment plant was completed at the refinery. A new Gulf FCC process was installed in revamped older units of the refinery. The FCC process combined the great capabilities of zeolites as catalyst and several design changes to attain high-temperature, short-contact-time, riser cracking. Reportedly, gasoline yields were increased up to 7%, and a 50% to 70% selectivity of C_3, C_4, and C_5 products was achieved.

Power Generation.—Pennsylvania electric utilities consumed 33,469,277 tons of bituminous coal and 1,583,831 tons of anthracite in 1972 and produced 5.5 million tons of ash including approximately 1.2 million tons of bottom ash and slag and 4.3 million tons of fly ash.

The utilities received 35,691,218 short tons of bituminous coal, thereby increasing stocks by 2,221,921 tons to 8,584,275 tons at yearend, equal to about an 87-day supply based on the average daily consumption in 1972.

Construction continued on the $328 million Bruce Mansfield Station of the Central Area Power Coordination Group (CAPCO) at Shippingport. The first of two 880-megawatt (MW) generating units was scheduled for operation in 1975. The plant will have an Ohio River dock to receive fuel coal, much of which will come from southern Ohio.

According to a United Gas Improvement Co. (UGI) official, no construction was started in 1972 on a 300-MW steam-electric plant in the Northern anthracite field. The plant will be fueled with upgraded culm bank material burned in Ignifluid combustion furnaces.[14]

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[13] Walters, R. M. How an Urban Refinery Meets Air-Pollution Requirements. Chem. Eng. Prog., v. 68, No. 11, November 1972, pp. 85–88.

Because of the high investment required for the proposed conversion to meet air pollution standards, Duquesne Light Co. planned to close its Brunot Island Station by April 1973.

In November, the Babcock & Wilcox Co. received a $27 million contract to build a 1,005°F coal-fired steam generating unit for the new 630-MW capacity Homer City Station of the Pennsylvania Electric Co. (PENELEC) and the New York State Electric & Gas Corp. Construction of the radiant boiler unit was planned to start in July 1, 1973, with initial startup scheduled for late 1976. The unit is a part of the $200 million joint expansion program that will bring the total investment in the Homer City Station to about $400 million.

The Delaware River Basin Commission (DRBC) disclosed a master plan submitted by electric utilities that included the following proposed fossil-fueled plants: The Philadelphia Electric Co. planned two 750-MW units at Croyden, Pa., to be operable in 1986, and the General Public Utilities Corp. (GPUC) planned two 316-MW units near New Hope, Pa., to be operable in 1980. In March, the Pennsylvania PUC ordered all electric utilities in the State to furnish data on generating capacity, forecasted load growth, customer demand. and anticipated plant construction.

Because of Agnes, Pennsylvania Power & Light Co. (PPL) had $11 million in damages of which $7.4 million occured at its coal-fueled Brunner Island Station located 15 miles south of Harrisburg. PPL suffered forced outages totaling about 2,100 megawatts. The Philadelphia Electric Co. had forced outages totaling 2,114 megawatts. The 1,700-megawatt Conemaugh Station, jointly owned by nine companies, had all capacity shutdown. Also affected were PPL's 110-megawatt Holtwood Station and the 10-megawatt Lock Haven plant. PPL's 52-megawatt Stanton Station near Scranton was not returned to service because it was scheduled to be closed October 1 because of new air pollution regulations. Only the Portland Station, one of Metropolitan Edison Co.'s five base-load plants, remained in service with its normal output augumented by 11 of its 13 peak-load generators. Construction activities on Metropolitan's Three Mile Island nuclear units were not affected by Agnes' floodwaters.

The following estimates of 1972 and future use of fossil fuels by some Pennsylvania electric utilities were obtained by the Keystone News Bulletin 20th Annual Electric Utility Survey (all data are in thousands of coal equivalent tons):

	1972	1973	1974	1975	1976	1980
Duquesne Light Co.:						
Coal	5,386	4,939	4,690	4,430	4,715	NA
Oil	15	52	148	152	149	NA
Pennsylvania Electric Co.: Coal	12,542	13,062	13,132	13,001	13,034	13,695
Pennsylvania Power Co.: Coal	1,003	870	NA	NA	NA	NA
Pennsylvania Power & Light Co.:						
Coal	7,050	8,568	9,222	8,831	8,778	NA
Oil	364	415	310	1,550	1,550	NA
Philadelphia Electric Co.:						
Coal	3,310	3,640	3,620	3,620	3,620	3,600
Oil	5,712	6,300	6,340	5,255	5,300	6,800
Gas	106	NA	NA	NA	NA	NA

Pennsylvania nuclear plants having more than 100-MW gross capacity that were being constructed or were on order as of December 1, 1972, and all of which will use pellet-type nuclear fuel, totaled 10,163 megawatt initial gross capacity for 10 units in six plants. This amount of generating capacity if fueled by bituminous coal would require 24 to 29 million tons annually. The year of commercial operation and the distribution of the total initial gross capacity of the 10 units in magawatts follows: 1972, 1,098; 1973, 1,973; 1974, 1,782; 1975, 2,049; 1977, 1,090; 1979, 1,085; and 1981, 1,085.

Metropolitan Edison Co. reported that total construction costs will be $750 million for its Three Mile Island nuclear plant at Goldsboro that will use light-water reactors. The first of two 850-megawatt generating units was scheduled for operation about May 1974 and the second unit about May 1976. The plant's output will be pooled by 12 utility companies that supply 14 southeastern Pennsylvania counties and parts of New Jersey and Maryland.

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[14] Demmy, R. H. Ignifluid Boilers for Utilities. Chem. Eng. Prog., v. 68, No. 2, February 1972, pp. 68–69.

GPUC announced plans to build two 1,200-MW nuclear-powered units near an existing fossil-fueled plant at Portland, Pa., to be on line in 1981 and 1983, and one 1,200-MW nuclear unit ready for operation in 1985 near Reading.

In a report submitted to the DRBC in January, Philadelphia Electric Co. disclosed plans to build three nuclear generating plants in addition to four other plants under construction in 1972. The proposed plants and their location are the Eastern Chester County Station on Brandywine Creek; and the Upper Delaware Station and the Lower Lehigh Station, both on Tohikon Creek in Bucks County. Each Bucks County plant is to have 1,500 megawatt capacity, and their commercial operation is scheduled for 1983 and 1985. Reportedly, the company will spend $2.2 billion for nuclear powerplants during a 5-year period. This expenditure is about 4.4 times the company's current annual operating revenue. In July, the company ordered four 600-megawatt turbogenerators from Westinghouse, that will be used with two high-temperature gas reactor (HTGR) systems to be supplied by the Gulf General Atomic Co. Division of the Gulf Oil Corp. Commercial operation dates for the four turbogenerators and the two HTGR systems are scheduled for 1979 and 1981 at an undertermined site. Gulf General by yearend 1971 had completed successful tests using a design prototype HTGR system in Philadelphia Electric Co.'s Peach Botton Station at Delta, Pa. The HTGR system eliminates water thermal pollution because gaseous helium is used as coolant.

PPL disclosed plans for two 1,120-megawatt nuclear plants to be located at an undetermined site near the boundary of Lehigh and Bucks Counties, to be commercially operable in 1983 and 1985.

The U.S. Supreme Court on April 3 ruled that States may not set more stringent radiation standards than those established by AEC. Because Pennsylvania for several years had limited radioactive emissions to 1% of the amount permitted by the AEC, the DER insisted that nuclear powerplants meet DER standards.

Three environmental groups and Pittsburgh's Mayor in a December 11 meeting objected to the $340 million Beaver Valley nuclear powerplant at Midland for environmental and economic reasons. At yearend, the plant was 60% completed.

NONMETALS

Cement.—Portland cement shipments from 20 plants in eight counties were 4.6% greater in tonnage and 11.1% greater in value because of an average increase of $1.10 per short ton compared with 1971. Masonry cement shipments from 18 plants were 7.6% greater in tonnage and 10.3% greater in value because of an average increase in value of $0.66 per short ton.

For the purpose of cement surveys the State is divided into an eastern district having five producing counties and a western district having three producing counties. The districts are separated by the eastern boundaries of Potter, Clinton, Centre, Huntingdon, and Franklin Counties. Eighteen plants operated both kilns and grinding plants, and two plants performed grinding only on interplant-transferred clinker at West Conshohocken and Plymouth Meeting.

Pennsylvania ranked second in the list of U.S. portland cement-producing States. Northampton and Lawrence Counties collectively accounted for 59.8% of the total portland cement shipments and 55.1% of the total masonry cement shipments.

The distribution of plants using wet or dry manufacturing processes was as follows:

	District	
	Eastern	*Western*
Plants using—		
Wet process	4	3
Dry process	9	2

Raw materials used in the manufacture of portland and masonry cements totaled 13,578,899 short tons and comprised 7,560,643 tons of cement rock, 4,782,796 tons of limestone, 307,944 tons of sand and sandstone, 256,826 tons of shale, 104,033 tons of clays, 110,814 tons of blast furnace slag, 12,684 tons of gypsum, and a total of 443,159 tons of bauxite, domestic and imported clinker, iron ore, and other ferrous materials.

Eighteen plants at yearend had 59 kilns with a total rated maximum 24-hour capacity totaling 26,417 short tons. These 18 plants, together with two plants performing grinding only, consumed 598,000 cubic feet of natural gas, 622,000 barrels of fuel oil, 1,658,000 short tons of bituminous coal, 25,000 short tons of anthracite, 27,242,000 kilowatt-hours of generated electricity, and 1,156,593,000 kilowatt-hours of purchased electricity.

The mode of transportation, type of packaging, and destinations of finished portland cement shipments in short tons follows:

Mode of transportation	From plant to terminal		From terminal to ultimate consumer		From plant to ultimate consumer	
	Bulk	Container	Bulk	Container	Bulk	Container
Railroad	654,527	32,702	64,111	7,122	1,388,873	186,384
Truck	75,108	3,172	700,821	23,169	5,049,167	765,009
Barge	82,248	--	--	--	29,631	--
Total	811,883	35,874	764,932	30,291	6,467,671	951,393

Portland cement consumed in the State totaled 3,276,930 short tons (39.9% of the total shipments), and 154,074 tons of masonry cements were consumed in the State (34.1% of the total shipments).

United States Steel's subsidiary, Universal Atlas Cement, closed its Penn Hills plant for 2 months to install a new clinker cooling unit that was expected to reduce dust emission by 96%.

The Whitehall Cement Mfg. Co. completed installation of a $500,000 fiberglass bag collection system for kiln dust at Cementon. The company planned to build a 235,000-ton-per-year kiln with a preheater. The $9 million expansion program, scheduled for completion by mid-1975, will increase the annual capacity of the Cementon plant by 45%.

Allentown Portland Cement Co., Division of National Gypsum Co. reactivated an old kiln at its Evansville plant.

Coplay Cement Mfg. Co., at Coplay, acquired a plant at Egypt, adjacent to the Coplay plant, from Giant Portland Cement Co. in early 1972 for $453,963, which had been idle since December 1969. The intallation of a fiberglass baghouse was started, and two of the eight kilns were placed in operation by midyear. When completed by mid-1973, the annual capacity of Coplay-Egypt plant complex will be increased by 260,000 tons to a total of 1,350,000 tons. The company planned additional annual kiln capacity of 320,000 tons to be installed in 1975 at the Coplay plant. Installation of preheaters on kilns at the company's Nazareth plant increased output capacity by 64,000 tons per year.

In October, the Lehigh Portland Cement Co. announced an industrial, commercial, and residential development program on a 1,400-acre tract at the site of the firm's former Fogelsville cement plant. Site preparation and development work on the project, named Iron Run, was expected to begin in 1973.

Cement production reached a record level at the Bath, Pa., plant of Keystone Portland Cement Co. Net sales in 1972 were $14.98 million, and net income was $1.16 million.

Production and shipments established records for the third straight year at the Whitehall plant of Whitehall Cement Mfg. Co. Net income in 1972 was 8.33% of sales and totaled $12.84 million.

Clays.—Including kaolin, the total production of all clays and shales was 12.9% greater in tonnage and 67.4% greater in value compared with 1971 because of an average increase in value per ton to $5.90 from $4.02 in 1971. Clays were produced in 27 counties by 48 companies. Production and value data follow:

Type of clay	Producing counties	Production (thousand short tons)	Value (thousands)	Average value per ton
Common clay and shale	28	1,858	$5,406	$ 2.91
Fire clay	10	769	9,810	12.76
Kaolin	3	55	613	11.15
Total	XX	2,682	15,829	5.90

XX Not applicable.

Seven companies, each producing more than 100,000 tons, collectively produced 1,526,062 short tons, equaling 56.9% of the total production and 72.0% of its total value.

The Pennsylvania Geologic Survey in cooperation with the U.S. Geological Survey participated in a two-phase clay-shale program in the Greater Pittsburgh Regional Area. Phase 1 consisted of a comprehensive compilation of existing lithologic, physical, mineralogical, and use data, on clay-shale samples from Allegheny, Armstrong, Beaver, Butler, Washington, and Westmoreland Counties. Phase 2 was concerned with the collection and analysis of new data on clay-shale resources in the area. The Bureau of Mines and the Pennsylvania Geologic Survey under a cooperative agreement began laboratory tests to determine the properties and potential uses of samples from the six-county region.

The Bylite Corp., Wilkes-Barre, manufactured Lelite by bloating metamorphic, carbonaceous shale. The raw material came from the 13-million-ton Prospect bank, an accumulation resulting from nearby anthracite mining in the 1836–1936 period. The Prospect bank was the last remaining, large, uncontaminated shale bank in the Lehigh Valley. The separation of carbonaceous shale from anthracite by heavy media separation resulted in the recovery of about 15-weight-percent salable anthracite. The recovered carbonaceous shale was crushed to minus ¾-inch size before sintering on a 15-foot-wide, 50-foot-long grate. Oil-fueled burners were used to attain a 2,800° F ignition temperature during the first 5 feet of grate travel. About 450 tons per day of bloated shale was produced when using a 14-inch-thick bed and a 1-foot-per-minute grate-travel rate. Lelite, one of the oldest lightweight aggregates produced in the eastern United States, was marketed in four basic sizes.

The A.P. Green Refractories Co. permanently abandoned, on January 6, 1972, the Dimeling No. 1 clay strip mine in Lawrence Township, Lawrence County.

Table 22.—Pennsylvania: Clays sold or used by producers, by use, in 1972

Use	Short tons
Common brick	412,384
Face brick	1,024,822
Firebrick, block, and shapes	639,205
High-alumina refractories	37,269
Brakes, clutches, and linoleum	1,748
Lightweight aggregate	72,500
Mortar and cement, refractory	43,728
Portland and other cements	273,181
Sewer pipe	95,274
Drain, quarry, and structural tile	33,292
Other [1]	29,828
Exports:	
Refractories	9,486
Brick and glazed tile	8,834
Total	2,681,551

[1] Includes animal feed, flue linings, paint, pesticides and related products, refractory grogs and crudes, rubber, and water treatment.

Pennsylvania manufacturers of refractories, plant locations, and products, according to Industrial Minerals,[15] are listed in table 23.

Fluorspar.—Fluorspar briquetting and pelletizing plants were operated in 1972 by the Cometco Corp., Duquesne, and the Glen-Gerry Shale-Brick Corp., at Reading.

Gem Stones and Minerals.—A new Triassic copper occurrence of malachite and azurite on fractures in hornfels (a sediment altered by an igneous diabase) was reported near Rossville, York County. Channel samples representing ten feet of section contained: 0.6% copper; 0.01 ounce of gold per ton; 0.2 ounce of silver per ton.

Glass.—PPG at its new Mount Holly Springs plant in Cumberland County started operating one float glass line in April and a second line in July. When in full operation, the half-mile-long, 25-acre facility will have 850 employees and a $9 million annual payroll. The plant has a potential annual production of 300 million square feet of glass for use primarily by the transportation and construction industries.

Ponds were built at the plant for the air cooling of heated cooling water before disposal of a portion by seepage into the ground and discharging the remainder into a trout stream. PPG's operations in Pennsylvania included a float glass plant in Meadville; fabricating plants at Creighton, Ford City, Greensburg, and Tipton; a glass research center at Harmarsville; and satellite laboratories at Creighton and Ford City. PPG announced on September 14 the transfer of some insulating, reflective, and heat-strengthened glass making operations from Creighton to Ford City. The transfer was expected to be complete in January 1973 and result in the loss of about 50 jobs in the Creighton area. At the Tipton fabricating plant, a multi-million-dollar expansion program began, which will increase the plant's tempering capacity by 50%.

Employees of the Dearborn Glass Co. plant in Jermyn, Lackawanna County, were recalled April 20 to ready the plant for a return to full production following ratification April 19 of a 2-year contract with Allied Technical Workers of America and Canada. The 70-employee plant manufactured face plates for color television sets.

Graphite.—Compared with 1971, the total tonnage of shipments of synthetic powder, scrap, and other graphite products was 31.8% greater although the value of production increased only 15.5%. Three companies collectively produced anodes, elec-

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[15] Industrial Minerals. Refractories in the USA. No. 62, November 1972, pp. 9–27.

Table 23.—Pennsylvania: Refractories manufacturers

Manufacturer	Plant location	Products
A. P. Green Refractories Co., subsidiary of United States Gypsum Co.	Climax	Firebrick.
Do	Philadelphia	High-alumina brick and monolithics.
Do	Tarentum	Brick, basic.
BMI Inc	Carnegie	Monolithics, basic and nonbasic.
Bognar & Co	Pittsburgh	Do.
Butler Refractories Div., Spang & Co.	Butler	Monolithics, nonbasic.
C—E Refractories Div., Combustion Engineering, Inc.	Port Kennedy	Castables, high-alumina shapes, kiln furniture, crucibles, mortars.
G. & W. H. Corson Inc	Plymouth Meeting	Bricks, monolithics, nonbasic.
Dolomite Brick Corp	York	Brick.
Drexel Refractories Inc., Drexel Dynamics Corp.	Kittanning	Brick, monolithics, nonbasic.
Foreco Inc	Mt. Braddock	Brick, shapes, nonbasic.
J. H. France Refractories Co	Snowshoe	Alumina-silica brick and monolithics.
Do	Windburne	Moldable refractories.
Freeport Brick Co	Freeport	Brick, shapes, nonbasic.
Garfield Refractories Co	Bolivar	Brick, monolithics, nonbasic.
General Refractories Co., U.S. Refractories Div.	Claysburg	Silica brick.
Do	Frankstown	Quartzite materials.
Do	Salina	Fireclay brick.
Do	Sproul	Monolithics, insulating brick.
Harbison-Walker Refractories Div., Dresser Industries, Inc.	Clearfield	Fireclay and high-alumina brick and monolithics, structurals.
Do	Mt. Union	Siliceous and silica refractories.
Do	Templeton	Fireclay brick.
Haws Refractories Co	Johnstown	Shapes, nonbasic.
Interpace Corp., Shenango Refractories subsidiary.	Grove City	High-alumina crucibles, brick and kiln furniture.
Do	New Castle	
Johns-Manville Corp	Zelienople	Insulating firebrick shapes and fibers; castables, gunning, mixes and mortars.
Lava Crucible—Refractories Co	Pittsburgh	Crucibles, monolithics, basic and nonbasic.
Lavino Div., International Minerals & Chemical Corp.	Philadelphia	Brick, monolithics.
Mt. Savage Refractories Co	Pittsburgh	Shapes, monolithics, nonbasic.
National Crucible Co	Philadelphia	Crucibles, monolithics, nonbasic.
North American Refractories Div., Eltra Corp.	Curwensville	Fireclay brick, high-alumina brick, castables, moldables, ramming mixes, mortars.
Do	Mt. Union	Silica brick and mortars.
Do	Womelsdorf	Refractories, brick.
H. K. Porter Company, Inc	Vanport	Do.
Resco Products, Inc	Norristown	Brick, shapes, monolithics, nonbasic.
Ross-Tacony Crucible Co	Philadelphia	Crucibles, shapes, basic and nonbasic.
Hiram Swank's Sons	Johnstown	Brick, shapes, nonbasic.
Union Mining Co., Inc	Pittsburgh	Brick, monolithics, nonbasic.
Vesuvius Crucible Co	do	Crucibles, shapes, nonbasic.

tric motor brushes, and machined shapes, unmachined shapes, shapes and plates for the aerospace industry, and powder and scrap for carbon raisers, for the steel industry, and for unspecified uses. The principal raw materials used for synthetic graphite production comprised petroleum coke, lamp black, pitch coke, black oil, hydrocarbon gases, and unspecified additives.

The Pure Carbon Co., Inc., St. Marys, announced the development of highly porous carbon plates and tubes for filtering corrosive liquids and gases where purity was critical. Most of the company's grades offered in the Purebon series of materials were easily moulded and could be cleaned and reused after treatment with appropriate chemicals. Experimental grades ranged from 9- to 77-volume-percent porosity, and from 0.53- to 1.82-gram-per-cubic-centimeter density, and had surface areas ranging up to 600 square meters per gram.

Gypsum.—United States Gypsum Co. calcined gypsum at Philadelphia in Philadelphia County. Output and value were approximately 46% greater than in 1971.

Iodine.—Inorganic and organic iodine compounds were produced from crude iodine by the Foote Mineral Company, Chester County; Whitmoyer Laboratories, Inc., Lebanon County; and West Agro-Chemical, Inc., Washington County. The iodine products comprised potassium iodide, lithium iodide brine, hydriodic acid, ethylene diamine dihydroidide, and phenothiazine.

Lime.—Nine companies produced lime at 11 plants in nine counties. Leading counties were Centre, Lebanon, and Butler. Leading producers were Bethlehem Mines Corp., Warner Co., and Mercer Lime & Stone Co. Output increased 7% but was 6% below the 1969 record. Among the States, Pennsylvania ranked third in lime production. The lime was used for steel furnaces, water purification, refractories, mason's lime, and other uses. The lime was consumed in Pennsylvania, Maryland, Ohio, New Jersey, and other states. Total consumption of lime in Pennsylvania was 2,252,000 tons.

Compared with 1971, the average value for all lime increased from $17.05 to $17.88 per short ton, hydrated lime increased from $19.56 to $21.03, and quicklime increased from $16.47 to $17.12.

Construction started in February on two separate baghouses to control dust emissions from five rotary kilns in Bethlehem's lime plant at Annville. The baghouses will contain fiberglass bags treated with silicone and graphite.

Recipients of the 1972 National Lime Association Certificate of Achievement in Safety included the quarry and lime plant of J. E. Baker Co., York, with over 100,000 man-hours without a disabling injury, and the underground mine and lime plant of National Gypsum Co., Bellefonte, with 270,000 man-hours without a disabling injury.

Mica.—Micalith Mining Co., Inc., at its Hokes mill near Gleville in York County produced ground scrap and flake mica. In national rank, Pennsylvania was seventh in quantity and eighth in value of mica production.

Mullite.—The Remmey Div., A.P. Green Refractory Co., in Philadelphia County produced high-temperature sintered synthetic mullite. Compared with 1971, production and value declined 6.9% less and 7.1% respectively.

Perlite.—Crude perlite was shipped into the State and expanded at seven plants operated by six companies in seven counties. Compared with 1971, the total sold or used was 31.4% greater in quantity and 32.9% more in value. The average value in 1972 was $55.96 per short ton compared with $55.33 in 1971.

Expanded perlite was sold or used chiefly for roof insulating board and other formed products, for plaster, and as horticultural aggregates. Minor uses were for masonry and cavity fill insulation, low-temperature insulation, and Ekoperl products.

Sand and Gravel.—Seventy-five companies used 80 stationary plants, 11 portable plants, and 14 dredges to produce sand and gravel at 89 operations in 37 counties. The approximate quantities in million tons transported from producing sites by various means were as follows: 12.6 by truck, 0.6 by railroad and 5.6 by waterway. Leading producing counties were Bucks, Erie, West-

Table 24.—Pennsylvania: Lime sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Basic oxygen furnaces	732	11,607	852	14,219
Water purification	134	2,380	181	3,033
Construction	125	2,429	129	2,908
Electric furnaces	96	1,449	79	1,328
Sewage treatment	71	1,254	72	1,206
Agriculture	20	341	71	1,313
Acid mine water neutralization	W	W	35	585
Paper and pulp	42	664	22	372
Tanning	10	179	6	114
Other uses [1]	530	9,703	444	8,724
Total	1,760	[2] 30,008	1,891	33,802

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes open-hearth furnaces, refractory dolomite, miscellaneous chemicals, other metallurgy, insecticides, explosives (1972), silica brick, wire drawing, food, ore concentration, petroleum refining, paint, alkalies, chrome (1971), magnesite (1971), sand lime brick (1971), sugar refining (1971), and uses indicated by symbol W.

[2] Data do not add to total shown because of independent rounding.

moreland, Lycoming, and Wyoming, which accounted for 50.8% of the total quantity and 44.9% of the total value.

The quantity of sand and gravel produced was 4.6% less but its value was 1.8% greater than that in 1971. Average value increased from $1.84 in 1971 to $1.96 per ton. Sand production was 3.9% greater and its value was 6.0% greater because of an average increase in value from $1.97 to $2.01 per ton. Sand used for building and paving purposes increased 3.8% in tonnage and 5.0 cents per ton in value. Ground and underground sands for industrial uses classed as molding, fire and furnace, glass, grinding and polishing, blast, engine, oil (hydrafrac), filtration, enamel, fillers, foundry, pottery, and miscellaneous totaled 3,993,000 short tons at an average value of $2.07 per ton, compared with 3,211,000 short tons, at $2.41 per ton in 1971. Gravel production decreased 14.8% in tonnage although its value was only 4.1% less than in 1971 because of an average 21-cents-per-ton increase. All except 6.1% of the total gravel production was used for construction purposes. Gravel accounted for 40.9% of the tonnage and 39.4% of the value of all sand and gravel production.

DER, in a major policy change in late February, banned dredging in untouched portions of the upper Allegheny River and elsewhere. Effective at the same time were restrictions applicable to existing dredging sites that banned dredging at night or during weekends, that prohibited the removal of sand and gravel from areas within 50 feet of the low-water mark onshore, that required boundaries to be clearly defined and marked, and that required that dredging must be gradually sloped. The area most affected by the new regulations was a 100-mile section of the Allegheny River between Freeport and Warren where there were six private dredging operations. Operators of each dredge paid $30 for a State permit and paid to the Fish Commission 10 cents for each ton of sand and gravel produced.

The Dravo Corp. in September announced plans for a $3.3 million sand and gravel plant at Georgetown. The plant will process materials from a 125-acre land deposit and from dredging in the Ohio River. Initial annual capacity will be 960,000 tons to be later expanded to 1.5 million tons. Construction will begin in the spring of 1973, and the plant should be operable in early 1974.

The Royer Foundry & Machine Co. demonstrated a new sand recycling system for air-set and no-bake foundry sands. Reclamation of these special chemical bonded sands was expected to save foundry operators thousands of dollars annually. Additionally, the patented equipment will reduce air pollution because the totally enclosed system uses dust collectors.

Table 25.—Pennsylvania: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	4,651	8,352	5,164	9,265
Fill	135	250	100	129
Paving	2,678	4,700	2,441	4,649
Other uses [1]	3,211	7,727	3,384	8,247
Total [2]	10,675	21,029	11,090	22,291
Gravel:				
Building	4,330	6,874	3,992	7,389
Fill	768	1,001	340	301
Paving	2,994	6,141	2,866	5,940
Miscellaneous	W	W	363	747
Other uses [3]	902	1,118	106	137
Total [2]	8,994	15,134	7,667	14,513
Total sand and gravel [2]	19,668	36,162	18,757	36,804

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes blast, engine, filtration, fire and furnace, glass, grinding and polishing, molding, oil (hydrafrac), ground, railroad ballast (1972), and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes miscellaneous (1972) and other gravel.

Silica and Quartz (Manufactured).—Glasrock Products, Inc., Washington, produced fused silica in grain and fabricated forms.

The P. R. Hoffman Co., Carlisle, produced manufactured (synthetic) quartz crystals for its own use and for sale to other quartz crystal cutters. Pennsylvania was one of the major producers of finished synthetic quartz crystals for the electronic industry.

Slag.—In the 1971 National Slag Association safety contest for slag processing plants the Midland plant of the International Mill Service, Philadelphia, won a Class A-plaque because it had 158,400 man-hours without a disabling injury. Plants with a continuous no-lost-time accident record for five or more years were Bethlehem's slag plant (5 years, and the Johnstown plant of the Standard Slag Co. (9 years).

The Warner Co. of Philadelphia was installing a $500,000 dust control system at its blast furnace slag plant in Tullytown. Two bag-type collectors were to be installed in the blacktop plants and two in the Calumite operation where finely ground slag was prepared for use by the glass industry.

The Clairton slag plant in the late 1972 was installing and testing a baghouse collector before the plant resumed operation in the spring of 1973.

Stone.—Pennsylvania was the country's leading stone producer. Adams, Berks, Bucks, Chester, Lancaster, Montgomery, Northampton, and York Counties each produced more than 3 million short tons. Collectively, these eight counties accounted for 54.3% of the total quantity and 55.2% of the total value. The total output of the 48 producing counties was 4.4% greater and its total value was 5.0% greater than in 1971. The average value in 1972 was $1.85 per short ton, up 1 cent per ton compared to 1971.

Dimension stone produced at 32 quarries in 11 counties accounted for 0.13% of the total tonnage and 3.78% of the total value of all stone produced. The average value of all dimension stone increased to $51.60 per short ton from $49.20 in 1971. The type of dimension stone and the number of producing quarries were as follows: sandtone, 18; slate, 8, other stone 3, traprock, 2, and quartzite, 1. Dimension quartzite, sandstone, traprock (basalt), and other stone were used primarily for irregular shapes and sawed stone. Slate was primarily used for blackboard and flagging. Slate accounted for 37.4% of the total production of dimension stone and 77.2% of its total value.

Crushed and broken stone produced at 216 quarries in 47 counties accounted for 99.87% of the total stone production and 96.22% of its total value. No crushed and broken stone was produced in Potter County although some dimension stone was produced. The average value of crushed and broken stone produced was $1.78 per short ton, up 2 cents per ton from 1971.

The number of operations producing crushed and broken stone was as follows: limestone, 160; sandstone, 26; traprock, 16; quarzite, 8; dolomite, 4; granite, 2; and other rock, 2. The major uses for crushed and broken granite, limestone, quartzite, sandstone, traprock, and other stone was for road aggregates and road base stone. The major use of dolomite was for the preparation of calcined products.

Crushed and broken limestone accounted for 81.0% of the tonnage and 78.5% of the total value of crushed and broken stone. The percentage distribution by use of the crushed and broken limestone was as follows: road aggregates and road base stone, 63.9; cement manufacture, 16.5; flux stone, 5.1; lime manufacture, 4.1; agricultural uses, 1.6; and 15 minor uses, 8.8.

Six companies in five counties prepared limestone suitable for mine dusting. The 1972 output had an average value of $4.94 per short ton and totaled 149,130 short tons, 37.6% less than the 238,955-short-ton production in 1971.

Crushed and broken stone was transported as follows in percent: truck, 82.7; railroads, 10.2; waterways, 0.5; and other methods, 6.6.

Although some stone quarries and sand and gravel pits were inconvenienced by Agnes flood waters, an estimate of damages was not available.

The GAF Corp. discontinued operations at its Delta quarry in York County where the firm for many years had crushed quarried slate to produce roofing granules.

Kerris & Helfrick, Inc., Mt. Carmel, opened the first new stone quarry in northeastern Pennsylvania in the past 30 years on a 300-acre site near Elysburg, Northumberland County. The new quarry, known as the Bear Gap Stone Co., supplied several grades of crushed sandstone for use as road base material and in ready-mix concrete for markets in the Mt. Carmel-Shamokin area. One of the quarry's products was used to provide skid resistance in an experimental road-surfacing project by the Penn DOT.

In July, the General Crushed Stone Co. doubled the capacity of its crushed stone plant at the Rock Hill quarry south of Quakerstown, Bucks County. The company completed an automated bituminous concrete plant April 15.

The Lancaster Lime & Stone Corp. announced plans in February to operate a quarry on a 307-acre tract near Lancaster. The permit for the quarry prohibited operations during evening hours, on Sundays, and during nearby funeral services.

The New Enterprise Stone & Lime Co., Inc., purchased the stock of Valley Quarries, Inc., Chambersburg. Facilities acquired included one quarry each near Chambersburg and Shippensburg; four ready-mix concerete plants in Chambersburg, Greencastle, Shippensburg, and Waynesboro; and two sand plants near Fayetteville.

The ninth National Limestone Institute (NLI) Safety Competition conducted by the Bureau of Mines and the NLI listed the following limestone quarries as having operated throughout 1971 without a disabling injury: Plymouth Meeting Quarry, G. & W. H. Corson, Inc., Plymouth Meeting, 129,296 man-hours; York mine, York Stone & Supply Co., York, 72,072 man-hours; Ormrod Quarry, Lehigh Stone Co., Ormrod, 26,250 man-hours; Herndon mine, Mechleys Limestone Products, Herndon, 10,725 man-hours; and the Sugar Hill Quarry, Sugar Hill Limestone Co., Brockaway, 6,225 man-hours.

The National Cooperative Highway Research Program (NCHRP), administered by the Highway Research Board, awarded a $50,000 contract to Valley Forge Laboratories Inc., Devon, Pa. The research agency in 15 months will inventory types, sources, and quantities of industrial, domestic, and mining waste materials potentially suitable for producing synthetic aggregates or otherwise replacing the needs for conventional aggregates in highway construction.

The American Marietta Corp. operated aggregate plants at Coolspring, Lake Lynne, Malvern, Pleasant Gap, and Williamson.

Table 26.—Pennsylvania: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone:				
Building stone	55	960	49	836
Curbing and flagging	24	637	21	542
Other uses[1]	29	3,718	22	3,318
Total[2]	108	5,314	91	4,696
Crushed and broken stone:				
Bituminous aggregate	6,048	11,019	6,125	10,860
Concrete aggregate	9,600	15,202	8,740	13,997
Dense graded roadbase stone	10,009	16,948	15,346	25,346
Macadam aggregate	1,340	2,254	2,018	3,969
Surface treatment aggregate	2,681	3,779	3,321	5,240
Unspecified construction aggregate and roadstone	12,689	20,985	7,404	13,024
Agricultural limestone	1,620	4,392	1,064	3,456
Cement manufacture	W	W	11,106	14,678
Fill	--	--	118	94
Filter stone[3]	271	500	W	W
Flux stone[4]	4,100	8,095	3,405	7,278
Glass	W	W	115	434
Lime manufacture	W	W	2,752	5,361
Mineral fillers, extenders, and whiting	--	--	508	2,667
Railroad ballast	619	1,036	1,500	2,564
Refractory stone	199	2,498	179	1,316
Riprap and jetty stone	187	327	676	1,393
Special uses and products[5]	W	W	154	769
Stone sand	W	W	444	1,052
Other uses[6]	14,996	26,125	2,240	6,146
Total[2]	64,359	113,155	67,216	119,644
Grand total	64,467	118,469	67,307	124,340

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes monumental, roofing slate, millstock, and uses not specified.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes stone sand (1971).

[4] Includes stone used in dead-burned dolomite (1971).

[5] Includes mine dusting and abrasives.

[6] Includes stone used in chemical stone (1971), roofing aggregates, dead-burned dolomite (1972), poultry grit, acid neutralization, building products (1972), disinfectant (1971), lightweight aggregate (1971), paper manufacture (1971), other soil conditioners (1971), and other uses not specified.

Table 27.—Pennsylvania: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972			Kind of stone produced in 1972
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Armstrong	5	249	525	4	178	397	Limestone.
Berks	11	4,018	5,475	12	4,649	6,377	Limestone, sandstone, traprock.
Blair	9	1,318	2,228	8	1,213	2,164	Limestone, dolomite, quartzite.
Bucks	14	5,030	9,257	20	4,929	7,631	Sandstone, traprock, limestone, granite, other stone.
Butler	5	1,623	3,679	7	1,592	3,894	Sandstone, limestone.
Carbon	--	W	W	3	101	W	Limestone, sandstone, quartzite.
Centre	8	2,710	4,810	9	2,537	4,245	Limestone.
Chester	7	2,085	2,963	7	3,536	5,908	Sandstone, limestone, traprock.
Clarion	3	206	W	3	220	W	Limestone.
Cumberland	6	W	3,258	6	1,758	2,998	Do.
Dauphin	3	W	1,311	4	1,659	2,667	Limestone, sandstone.
Huntington	6	673	2,347	5	667	1,236	Limestone, quartzite.
Juniata	--	--	--	1	242	366	Limestone.
Lancaster	15	4,968	9,177	17	4,350	7,974	Limestone, dolomite.
Lawrence	4	2,387	3,465	4	2,095	3,470	Limestone.
Lehigh	7	1,756	3,149	9	2,215	3,450	Slate, limestone.
Luzerne	3	1,134	1,741	4	669	1,072	Sandstone.
McKean	1	39	W	1	W	W	Do.
Montgomery	14	5,574	10,050	15	5,182	9,592	Sandstone, traprock, other stone.
Northhampton	20	6,433	11,538	17	6,020	11,388	Slate, limestone, quartzite.
Northumberland	3	235	520	2	W	W	Sandstone.
Potter	3	3	101	3	1	29	Limestone, sandstone, quartzite.
Schuylkill	3	162	W	3	W	670	Sandstone.
Somerset	4	457	1,225	4	874	2,101	Limestone, sandstone.
Susquehanna	7	W	553	7	W	661	Sandstone.
Westmoreland	8	1,692	3,378	10	1,758	3,657	Sandstone, limestone.
York	10	3,488	7,988	10	4,410	9,537	Limestone, dolomite, sandstone.
Undistributed[1]	[r] 54	18,228	29,736	52	16,454	32,861	Do.
Total[2]	233	64,467	118,469	247	67,307	124,340	

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes production for Allegheny (1971), Adams, Bedford, Cambria, Clinton (1972), Columbia, Delaware, Elk, Fayette, Franklin, Fulton, Jefferson, Lebanon, Lycoming, Mercer, Mifflin, Monroe, Montour, Perry, Snyder, Union, Washington, and Wayne Counties.

[2] Data may not add to totals shown because of independent rounding.

Sulfur.—Four petroleum refineries operated by four companies in Delaware and Philadelphia Counties used modified or improved Claus processes to produce 21,999 long tons of elemental sulfur (100%-basis). Shipments totaling 22,170 long tons (100%-basis) were 5.6% greater than in 1971 and averaged $24.00 per long ton ($3.14 per long ton greater than in 1971), and the total value of shipments was 21.5% greater. Stocks decreased 171 long tons during 1972.

One refinery in Philadelphia County used monoethanolamine in a Girdler system to recover hydrogen sulfide. Compared with 1971, production was 13.6% less, and shipments were 12.5% less in quantity and 16.0% less in value.

Compared with 1971, the total production of sulfuric acid on a 100% basis was 2.5% less and its value was 10% greater.

Talc.—Conestoga Minerals, Inc., announced discovery of the Talanco talc deposit in Fulton Township, southern Lancaster County. A drilling program indicated sufficient reserves to justify mining. Plans to develop the deposit were under study.

For the second consecutive year, no talc was produced by Summit Industries Inc., the State's former sole talc producer, in Adams County.

Tripoli (Rottenstone).—Crude tripoli was produced at two mines in Lycoming County. Compared with 1971, production was 2% greater and its value was 75% greater. The prepared material was sold or used as abrasives and fillers.

Vermiculite (Exfoliated). — Vermiculite shipped into the State was exfoliated by Hyzer & Lewellen, at Southampton; by the Construction Products Division, W. R. Grace & Co. at Ellwood City; and by the Vermiculite Industrial Corp. at Pittsburgh. Compared with 1971, the total quantity produced was 22% greater, the total quantity sold or used was 15.4% greater, and the total value of vermiculite sold or used was 9.2% greater. Uses in order of decreasing tonnage were loose fill aggregate, horticulture, and concrete aggregates. Plaster aggregates, pool base, roofing aggregates, and miscellaneous uses accounted for about 3% of the quantity sold or used.

METALS

Aluminum.—Ground was broken in early April for the fourth stage of the Aluminum Co. of America (Alcoa) Technical Center on a 2,300-acre site at Merwin, Westmoreland County. When completed in 1974, the addition will have 275 employees engaged in engineering research, and engineering, computer, purchasing, accounting, personnel, equipment manufacturing, and maintenance services. The Center developed the technology for a new aluminum process that decreases electricity consumption up to 30% and dispenses with the need for cryolite for processing raw alumina. Instead, alumina is reacted with chlorine to form aluminum chloride that is decomposed electrolytically to aluminum, and chlorine that is recycled. The process was developed during a 15-year, $25 million project.

Alcoa developed a new process to produce alumina fibers for use as insulation on space vehicles and for high-temperature industrial processes. The new material will cost $5 per pound or less, compared with several hundred dollars per pound for other alumina fibers available in 1972. The fibers can be used at sustained temperatures above 3,300°F, compared with 2,600°F for a currently produced high-heat-resistant insulation, which comprises 50% alumina and 50% glass fiber. Samples of the new fibers, which contain 99% polycrystalline alpha-alumina, will be available about mid-1974.

Beryllium.—The Kawecki Berylco Industries, Inc. (KBI) plant at Hazleton was the site of job safety discussions between KBI officials and representatives of the Oil, Chemical and Atomic Workers International Union (OCAW) that could set a precedent for the chemical industry. According to a KBI official, the firm spent $300,000 in the past 2 years to improve the working environment in the plant. KBI announced that its new continuous-cast-beryllium-copper rod was replacing wrought and hot-worked beryllium-copper rod for plunger tips in the die casting industry. A routine long tip life between sizings was obtained when using the new material. KBI started production in September of an improved beryllium-copper casting alloy called Berylco 21C. The alloy attracted attention in the automotive field, particularly for large, thin-walled castings where good reproduction and a polished surface are required.

National Beryllia Corp.'s Sealox Division plant in Plumsteadville, Bucks County, attained full production in August. The 40,000-square-foot, 100-employee plant, produced beryllium oxide ceramics for use in aerospace, nuclear, and undersea programs.

Carbide Metals.—Kennametal, Inc., Latrobe, produced cemented carbide tools and other related products. Particularly good gains in sales of mining and construction tools were noted. Hydro Carbide Corp., a subsidiary of Vulcan, Inc., started a new 30,000-square-foot, $1 million plant in Latrobe to produce specialty carbide metals. The new plant will triple Hydro's production capacity and also increase the size range of sintered tungsten carbide shapes.

Cobalt.—The permanent closure of Bethlehem's Cornwall iron ore mine, because of flooding in late June by Agnes, terminated the only domestic sources of cobalt. An official of Pyrites Co., Inc., Wilmington, Del., stated that the company received a small volume of cobalt-containing solution during January and February from Bethlehem's pyrite roasting and leaching operation at Sparrows Point, Md., that was phased out before yearend 1971. As a result, no production of cobalt was credited to Pennsylvania in 1972.

Copper.—The State's production of copper was 22.1% less than in 1971 because of the permanent closing of Bethlehem's Cornwall iron ore mine. The average value was 51.2 cents per pound, compared with 52.0 cents per pound in 1971.

Erie Electric Manufacturing Corp. started a rolling mill in Erie to produce unusual shapes of copper and other nonferrous metals. Although most of the plant's products were made from high-conductivity Lake copper, the new mill could also form aluminum, brass, and bronze into grooved, wedge, or special shapes with a minimum of tooling cost.

Iron Ore.—As a result of flooding caused by tropical storm Agnes on June 22, both the No. 3 and No. 4 mines at Bethlehem's Cornwall operation were permanently closed after 230 years of iron ore mining. After dewatering, the Cornwall open pit continued operating for the remainder of 1972 although the ore was expected to be depleted in March 1973. Bethlehem's Grace operations resumed production at the end of July following a 4-week vacation shutdown. The Grace Mines' mobile mining system, which attained full operation during 1970, included 8-ton-capacity, diesel-powered, load-haul-dump vehicles, a 2,500-foot-long conveyor belt, an ore crusher, and a complete equipment repair shop 2,200 feet underground. All main headings for the block-caving method used in the Grace mine were drilled by two, three-boom universal jumbos. The conveyor belt discharged into a hoist-loading pocket. At Cornwall, production and shipments of iron ore pellets were 39.3% less than in 1971; chalcopyrite production was 24.3% less but shipments were 30.5% greater. No pyrites was produced or shipped from the Cornwall operation. Compared with 1971, the Grace operation produced and shipped 6.2% more iron ore pellets. No pyrites was produced or shipped, and none of the chalcopyrite production was shipped. Total consumption of explosives at the Cornwall mine comprised 274,975 pounds of dynamite, 291,775 pounds of AN-FO, and 358,480 pounds of Flo-gel, a mixture of AN-FO and dynamite. At the Grace mine 660,200 pounds of dynamite and 119,250 pounds of AN-FO were consumed.

The tonnage of all iron ore pellets shipped from both operations was 13.1% less and their value was 11.6% less than in 1971.

Iron Oxide Pigments.—Finished natural and manufactured iron oxide pigments were shipped by three companies. Shipments were 12.5% greater and their value was 17.9% greater than those of 1971.

Iron and Steel.—According to the American Iron and Steel Institute, the State's raw steel production was 30,416,000 short tons compared with 27,665,000 short tons in 1971 and 30,031,000 short tons in 1970. Total blast furnace production of pig and silvery irons and ferroalloys totaled 20,840,000 short tons, 10.9% more than in 1971. Blast furnace production of ferroalloys accounted for 483,000 short tons of the total tonnage compared with 362,000 short tons in 1971 and 395,000 short tons in 1970.

Active blast furnaces numbered 26 on January 1 and 32 at yearend. Idle blast furnaces totaled 29 on January 1 and 23 at yearend. Solids charged into blast furnaces comprised 8,399,193 short tons of iron ores, 3,609,932 tons of regular sinter, 7,580,179 tons of regular iron ore pellets, 2,105,870 tons of agglomerates from foreign countries, 546,323 tons of limestone, 197,559 tons of burnt lime, 1,531,119 tons of dolomite, 132,848 tons of other fluxes, 350,610 tons of mill cinder and roll scale, 880,460 tons of steel furnace slags, 77,640 tons of raw flue dust, 12,754,701 tons of breeze-free coke, 83,929 tons of coke breeze, 11,724 tons of pig iron, 789,881 tons of home and purchased scrap, 111,583 tons of slag scrap, and 313 tons of alloys and miscellaneous solids. Blast furnaces produced 151,867 tons of scrap containing 112,078 tons of iron, 5,644,667 tons of slag, and 482,242 tons of recovered flue dust containing 173,125 tons of iron. The average blast furnace consumption of coke per short ton of hot metal was 1,224 pounds, 2 pounds greater than the national average. Supplemental fuels injected into blast furnaces through tuyeres comprised 3,174 million cubic feet of natural gas, 145 million cubic feet of coke oven gas, 21,952,172 gallons of bunker C oil, 30,037,207 gallons of No. 6 oil, 3,897,327 gallons of crude coal tar, and 4,332 short tons of stove coal.

Open hearth, BOF, and Bessemer steel furnaces consumed 525,641 tons of iron ores, 57 tons of regular sinter, 58,626 tons of regular iron ore pellets, 33,306 tons of agglomerates from foreign countries, 455,787 tons of limestone, 670,728 tons of burnt lime, 537,260 tons of dolomite, 85,788 tons of fluorspar, 308,324 tons of other fluxes, 12,162 tons of mill cinder and roll scale, 279 tons of anthracite, 18,447,545 tons of pig iron and hot metal, 11,205,023 tons of home and purchased scrap, 100,590 tons of slag-scrap, and 90,594 tons of other scrap.

Agglomerating plants consumed 11,628,757 tons of ores, 1,473,305 tons of limestone, 1,233,968 tons of dolomite, 98,711 tons of unspecified fluxes, 938,225 tons of mill cinder and roll scale, 638,120 tons of raw flue dust, 465,898 tons of steel furnace slag, 717,135 tons of coke breeze, and 230,556 tons of Pennsylvania anthracite. Agglomerating plants produced 2,819,221 tons of regular sinter and 10,443,692 tons of semi- and self-fluxing sinter.

Stocks of pig iron at furnaces totaled 179,912 tons at the start of 1972 and 161,130 tons at yearend. Pig iron and hot metal shipped for sale, transfered for interplant consumption and withdrawn from stock during 1972 totaled 20,374,283 tons and averaged $79.97 per ton in value. Stocks of agglomerates on January 1 totaled 313,549 short tons and 336,942 short tons on December 31. Stocks of iron ores declined from 10,875,547 tons on January 1 to 9,132,528 tons at yearend.

Alan Wood Steel Co., Conshohocken, during the year attained effective control of all current water pollution problems and reduced emission of coke oven air pollutants for which full control was not expected awaiting a DER consent decree on equipment modifications in the coke and chemical departments to reduce contaminant emissions. By yearend the Conshohocken plant's overall emissions were reduced to 3.7 tons per day—a 94% reduction from the 60-tons-per-day-base total emissions. The company expected to spend more than $6 per ton of annual raw steel capacity between 1971 and 1975, not including an undefined, continual, additional operating expense. The company received a $352,000 grant from EPA toward the cost of a $1.8 million demonstration water purification plant. Equipment added in 1972 included a scrubber and baghouse for removal of dust emitted at the sinter plant, a hot blast stove replacement, a blast furnace gas bleeder, and a 125,000-pound-per-hour package boiler. The Conshohocken plant, one of two in Pennsylvania, regularly used gas-oxygen and oil-oxygen lances as an auxiliary fuel, to preheat scrap charged into basic oxygen converters when the hot metal's silicon content was low.

The Beaver Falls plant of the Babcock & Wilcox Tubular Products Division during October started operation of five baghouses built at a cost of $11 million. The baghouses were designed to handle a total of 2.36 million cubic feet per minute of gases emitted by electric-arc furnaces in the Kippel and Wallace Run steelmaking shops. The system, comprised of 10,296 Dacron filter bags, each 31 feet long and about 1 foot in diameter, eleven 900-hp fans, and 12- and 14-foot-diameter ducts, will remove about 55 tons of particulates from the gases handled per day. In June, the firm awarded Ferro-Tech Industries, Inc., a contract for a turn-key project to design and install a system to handle 30 tons per day of particulates, and convert them into dustless micropellets. In September, Babcock & Wilcox started a $3.2 million expansion program, financed through loans by the Pennsylvania Industrial Development Authority (PIDA) and the Regional Industrial Development Corp. of Southwestern Pennsylvania. The expansion of the No. 1 melt shop at Wallace Run will include equipment for the argon-oxygen-decarburization of steel (AOD process) and for ESR refining. The AOD shop will have a 25-ton reactor in which argon and oxygen are blown through molten steel.

Allegheny Ludlum Steel Corp., a division of Allegheny Ludlum Industries, Inc., dedicated a $2.5 million plant in June to handle waste water in Harrison Township, Allegheny County, and started a $1.8 million plant in Brackenridge to process pickling rinse water and scrubber effluent. Plans were announced in December to spend $2,225,000 to build and install additional air and water pollution control systems in 1973 at its plants at Brackenridge and Natrona. This money was obtained following approval of a loan guarantee by the Allegheny County IDA.

The firm planned to spend $10 million in 1972 on a major expansion of its silicon electrical steel facilities and another $5 million in 1973 at its Bagdad Plant in West Leechburg. Automatic gage control equipment for a cold strip reversing mill was installed at the Bagdad plant. Installations were completed at the Brackenridge plant of a normalizing furnace, a 44- by 220-inch semiautomatic roll grinder, and equipment to treat hot strip mill water.

Floods caused by tropical storm Agnes closed the Bethlehem Steel Corp.'s (Bethlehem) Steelton Plant, damaged the rolling mill at Johnstown, and idled a structural steel fabricating plant at Pottstown.

Bethlehem and the DER signed a consent order that provided for the elimination of air pollution at the Bethlehem and Johnstown byproduct coke oven operations. The agreement prevented DER from prosecuting Bethlehem during the 5-year period provided in the order. However, Bethlehem was expected to take immediate steps to reduce emissions and to outline its long-range plans for specific procedures and equipment by December 31, 1972. The 5-year deadline called for coke ovens to release no visible emissions, other than water mist or vapor, in excess of No. 1 Ringelman or 20% opacity—a standard considered by Bethlehem's manager of environmental quality control as lacking in objective precision because of the uncertain availability of technology. Compliance with the consent order will cost Bethlehem $22.5 million or more. On August 29, the Northhampton County IDA offered $30 million in tax-exempt bonds to cover the costs of air and pollution control equipment in Bethlehem's plants as follows: Bethlehem plant—air quality controls for a new coke oven battery, $5.6 million; desulfurization of all coke oven gas, $5.4 million; and air and water quality controls for specialty steel units, $1.5 million. Steelton plant—electric furnace fume collection system, $6.0 million. Lebanon plant—collection and recirculation of mill waste waters, $2.6 million. Johnstown plant—desulfurization of coke oven gas, $5.5 million; ferromanganese blast furnace cast house fume collection system, $2.6 million, ferromanganese pig machine fume collection system, $0.3 million.

In J & L's Aliquippa Work, break in trials were completed in November on a wet scrubber and a 761,000-square-foot collector-area electrostatic precipitator complex at the BOF steelmaking shop. The complex, designed to remove particulates from 1.65 million cubic feet per minute of BOF exhaust gases, was expected to collect 250 tons per day of solids. The installation will allow J & L to operate simultaneously two of the shop's three furnaces without violation of clean air standards, and will make it possible for the Aliquippa Works to boost steel production by 5% or 200,000 tons per year.

Construction of air and water pollution control equipment at the Aliquippa Works was financed by the issue of $17.5 million in tax-free bonds in May by the Beaver County IDA. J & L during December completed the first phase of a $7 million program to rebuild the Aliquippa coke ovens and to reduce air pollution problems. Fifty-three ovens were restored to full production and were ready for the installation of equipment to curb emissions during the coal charging and coke pushing operations after the necessary technology is developed and proved.

In midyear, a $10 million project was started at Aliquippa to expand and modernize facilities for heating ingots to rolling temperature. The project, scheduled for completion in 1973, included a new larger building to house the older ingot soaking pits, a new battery of soaking pits, a new railroad track system, and three new overhead cranes. Open hearth furnaces phased out of operation several years earlier were demolished to make space for the new building.

J & L and ACHD agreed on a compliance order calling for desulfurization of coke oven gas at the Pittsburgh Works. The firm filed a third petition with ACHD for a control waiver ending March 1, 1974, to allow negotiations to continue for the purchase of 0.8% sulfur coal for the Southside steam-and-electric system of the Pittsburgh Works.

The Pittsburgh Works of J & L on January 21 tapped the first heat from an open hearth furnace since September 8, 1971. Two blast furnaces started production January 17, and three additional open hearth furnaces resumed operation January 25. About 2,000 workers were recalled to man these operations. The works continued to produce hot and cold finished bars although the production of billets, which are rolled into bars, was transferred to the Aliquippa Works where the faster and more flexible 200-ton BOF furnaces permitted a closer control on inventory than the 350-ton open hearth furnaces at the Pittsburgh Works. The continuous-casting unit at Aliquippa eliminated the time-consuming and costly ingot pouring, reheating, and primary rolling operations. The shift of operations allowed J & L to retire an old, inefficient 28-inch billet mill and a 44-inch blooming mill in the Pittsburgh Works. Six of the 11 open hearth furnaces in the Pittsburgh Works were equipped with roof burners that permitted the charging of 70% scrap and 30% molten iron. The use of roof burners and oxygen lancing reduced the refining time of open hearth steel from the normal 9 hours to 6 hours. Five open hearth furnaces and other facilities were shut down to permit the Pittsburgh Works to meet cost objectives.

Representatives of J & L and DER continued negotiations in September relating to the spillage of acidic mine water July 29 into Dunkard Creek when a retaining dam was damaged near J & L's Shannopin coal mine.

J & L's shipments of products from its Pennsylvania and Ohio operations totaled 5.1 million tons compared with 4.9 million tons in 1971. Records were set in steel production at the Aliquippa Works, and significant increases in productivity were attained in the primary operations of the Pittsburgh Works.

The Lukens Steels Co., Coatesville, produced high-purity steel plates and slabs in a new ESR facility. The Coatesville plant could produce slabs weighing up to 50,000 pounds and measuring 30 inches thick and 60 inches wide. Plates could be rolled up to 12 inches thick in weights up to 36,000 pounds. New equipment installed during the year included the ESR facility, a graphite storage and injection system for two electric furnaces, an additional 135-ton ladle, an enlarged car-bottom, heat-treating furnace, a plate demagnetizer, a hot top cutting machine scarfer, radio controls on nine overhead traveling cranes, and air pollution abatement equipment for two 100-ton, electric-arc furnaces. A $18.75 million melt shop expansion program was started during 1972 to include a fourth 150-ton electric-arc furnace slated for initial production in late 1973. This furnace will enable the phasing out of the remaining open hearth furnaces with minimal loss of production capacity. Included in the expansion program will be a $3.12 million expenditure for air and water purification equipment.

Luken's Coatesville plant in the first half of 1972 used about 6,300 gross tons of prereduced Midrex iron pellets equal to 12% to 22% of the materials charged into a 150-ton electric-arc furnace. The pellets were made by the Georgetown Steel Corp., Georgetown, S.C. and were hauled by barge from Georgetown, S.C., to Wilmington, Del., and then were moved by truck to Coatesville, Pa.

The Sharon Steel Corp., at its Roemer Works in Sharon, resumed production July 3 after 2,000 workers returned to work following a 2-day strike over safety issues. In September a $3.75 million Venturi scrubber system for use with the Kaldo BOF shop was formally dedicated at the Roemer Works. The corporation announced plans in June to install a conventional oxygen steel refining vessel with provision made to convert the vessel at a later date to a bottom-blown Q–BOP design. Sharon is 85.6% owned by the NVF Company, who also owns the Pennsylvania Engineering Corp., a builder of Q–BOP vessels. Sharon also made steel in two rotating Kaldo converters and several electric-arc furnaces, all of which had a combined capacity of only about 100,000 tons per month. Sharon announced in August that it would move the pipe and tube mill operated by its subsidiary, the Union Steel Corp., from Piscataway, N.J., to Greenville, Pa., adjacent to Sharon's Damascus Tube Division facilities, 11 miles from Sharon's plant in Farrell.

Sharon installed an AirPol Venturi scrubber and gas cooling tower for cleaning blast furnace gas at Farrell. The scrubber was designed specifically to operate with the modulating control of a blast furnace's top pressure. Other expenditures were made at Farrell for 60-inch hot-mill improvements, pickling line improvements, and a coating thickness gage on a galvanizing line.

After 9 months of court-supervised negotiations, attorneys of United States Steel Corp., DER and the Allegheny County Commissioners, in late October, signed the last two sections of a consent decree for correcting environmental problems at the Clairton Coke Works. The reduction of sulfurous emissions will be implemented by desulfurizing coke oven gas used to heat the coke ovens by February 1975, and the desulfurization of coke oven gas used for other fuel purposes by February 1977. It was also agreed that the firm will use low-sulfur-content coal in its steam generators in Allegheny County. The 87-oven No. 21 coke oven battery at Clairton was rebuilt and provided with newly designed doors and jambs 3 months ahead of schedule at a cost of $6 million, and rebuilding of the 87-oven No. 2 battery was started. Other projects in progress to reduce emissions included an oven-door-rebuilding program, the use of "electric-eye" equipmentspotting devices, the use of steam aspiration during the charging of coal into coke ovens, the use of a 4-year-old cryogenic system to remove up to 100 tons per day of hydrogen sulfide from coke oven gas, and a special training program for coke oven personnel.

Also signed in late October was the Quench Water Agreement that provided for more than 99% reduction in phenolics and 95% reduction of ammonia and other chemicals in waste waters discharged from the Clairton Coke Works. The agreement will terminate the quenching of coke using contaminated water by July 1975. Within a 3-year period a plant will be built to biologically treat and to remove ammonia from waste waters. In the same time period pilot plants will test methods to reduce the content of phenolics, cyanides, and thiocyanates in waste waters. The most effective system will be used in the full-scale treatment plant. The construction and operation of the pilot plants will be supervised by ACHD and DER personnel. Reportedly, it will cost $25 million to comply with the environmental standards covered by the two agreements and another $1 million for pilot plant research to determine the feasibility of further pollution controls.

DER filed suit November 22 against United States Steel for civil penalties totaling $518,000 for 94 alleged violations related to the discharge of phenolics, cyanides, oils, soluble iron compounds, acids, and settable solids from eight plants into the Monongahela River. The suit was filed with the Environmental Hearing Board, but its ruling may be challenged in the Commonwealth Supreme Court.

Charges were filed January 12 in the Federal District Court in Pittsburgh by the U.S. Department of Justice for violations of the 1899 Refuse Act. United States Steel was charged with spilling oil from its Homestead Works into the Monongahela River October 28, 1971, and with discharging coal tar from the Clairton Coke Works into Peters Creek June 29, 1971.

During 1972, a two-vessel BOF shop was completed at U.S. Steel's Edgar Thomson-Irvin Works in Braddock. Two electric-arc furnaces and a new wire mill containing eight wire-drawing machines were completed at the Fairless Works from which the first truckload shipment was made in mid-December. The new Fairless mill will concentrate on tonnage markets for bright-basic, hard-drawn mechanical and upholstery spring wire. The new mill replaces U.S. Steel's mill at Worcester, Mass., that was phased out in 1971.

The first heat was tapped January 10 from one of two new 220-ton BOF converters in the No. 5 shop of U.S. Steel's Homestead Works. The shop had five electrostatic precipitators to clean exhaust gases from the BOF converters.

The Wheeling-Pittsburgh Steel Corp. during December started to phase out wire and rod production at its Monessen Works. When completed in mid-1973 the phaseout will eliminate about 200 jobs but will not affect 2,600 other workers at Monessen. Shipments of wire and rod products averaged 49,000 tons annually in the past 5 years, or 76% less than the 207,000 tons shipped in 1955. Most of the tonnage decrease was blamed on imports.

Platinum.—Matthey Bishop, Inc. closed its old platinum refinery in Malvern March 31 but continued the production of platinum and other precious metals in a modern plant in the Malvern Industrial Park.

The Ford Motor Co., Detroit, Mich., signed a 3-year $70 million contract in December with Matthey Bishop for a platinum-based converter system to clean automobile exhaust gases. The contract was expected to supply 30% of Ford's requirements for vehicles to be manufactured in the 1975, 1976, and 1977 model years. Matthey Bishop will build a new facility to produce the honeycomb monolithic type of catalyst. The plant may produce about 2.5 million units per year when full production is attained in 1974.

Rare-Earth Metals.—The Molybdenum Corp. of America (Molycorp) operated rare-earth and cerium processing facilities in Washington and York. The York plant also produced lanthanum chloride. The consumption of cerium, the most abundant rare earth, continued to increase because about one-quarter of the U.S. flint glass container manufacturing plants used a new cerium decolorizing process to obtain a water-white transparency and to reduce the passage of harmful ultraviolet radiation into glass containers. The use of 3 ounces of cerium compounds per ton of glass produced reportedly reduced glass decolorizing costs by as much as 50%.

Molycorp and Alcoa formed a new company, Rare Earth Metals Co. of America

(Remcoa), to be 49% owned by Molycorp and 51% by Alcoa, to help meet the increasing demand for rare earth metals. Remcoa planned to construct a pilot electrolytic cell at Washington to produce misch metal, a mixture of rare-earth metals, the sales of which were to start in 1973. By 1974, Remcoa expected to have a full-scale plant in operation at a site to be chosen in early 1973.

Zinc.—The State's production of primary zinc came from the underground Friedensville mine, near Bethlehem, where a zinc sulfide replacement ore body in dolomitic limestone was mined by the open stope and room and pillar methods. Reserves were estimated August 1, 1966, at 5,332,818 tons of proven ore, averaging 6.5% zinc, and 13,023,250 tons of probable ore, averaging 6.7% zinc. The deposit has not been delimited according to a Gulf & Western Industries Inc. statement to shareholders. Zinc production was 33.2% less and its value was 26.3% less than in 1971, principally owing to ground subsidence problems and floodwaters from tropical storm Agnes.

The New Jersey Zinc Co., a subsidiary of Gulf & Western Industries Inc., added 4,000 tons annual zinc capacity at its Palmerton plant.

New Jersey Zinc Co. received a $135,843 grant from EPA to evaluate a process to recover sulfuric acid from liquid waste from the company's Gloucester, N.J. plant. The grant will terminate in June 1973. The process will be tested in a $250,000 pilot plant at the company's Palmerton works.

Zinc concentrates from the St. Joe Mineral Corp. Balmat-Edwards mining complex in northern New York were processed at the corporation's Josephtown electrothermic smelter at Monaca. The smelter has an annual capacity of 210,000 tons of slab zinc and 35,000 tons of zinc oxide. Approximately three-fourths of the total sulfuric acid produced by the New Jersey Zinc Co. at Palmerton and St. Joseph Lead Co. at Josephtown was consumed by the producers.

Table 28.—Principal producers

Commodity and company	Address	Type of activity	County
Abrasives:			
Nonmetallic: Satellite Alloy Corp.	9800 McKnight Rd. Pittsburgh, Pa. 15237	Plant	Allegheny.
Metallic:			
Abrasive Metals Co	26th and B. & O. RR Pittsburgh, Pa. 15222	do	Do.
Durasteel Abrasive Co	2601 Smallman St. Pittsburgh, Pa. 15222	do	Westmoreland.
Pangborn Div., the Carborundum Co.	Box 380 Hagerstown, Md. 21740	do	Butler.
Cement:			
Allentown Cement, Div., National Gypsum Co.[1]	7th St. at Thruway Allentown, Pa. 18101	do	Berks.
Allentown Cement, Div., National Gypsum Co.	do	do	Montgomery.
Bessemer Cement Co., subsidiary of Louisville Cement Co.	510 Hanna Bldg. Cleveland, Ohio 44115	do	Lawrence.
Coplay Cement Mfg. Co[1]	North 2d St. Coplay, Pa. 18037	do	Lehigh.
Do	Easton Rd. Coplay, Pa. 18037	do	Northampton.
G & W. H. Corson, Inc	Plymouth Meeting, Pa. 19462	do	Montgomery.
Martin Marietta Cement[1]	Box 5618 Baltimore, Md. 21210	do	Northampton.
Green Bag Cement Co., Div. of Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	do	Allegheny.
Hercules Cement Co., Div. of Amcord Inc.	1770 Bathgate Rd. Bethlehem, Pa. 18018	do	Northampton.
Keystone Portland Cement Co.[1]	2200 Hamilton St. Allentown, Pa. 18105	do	Do.
Lone Star Cement Corp[1]	Box 6237 West End Br. Richmond, Va. 23230	do	Do.
Medusa Portland Cement Co.[2]	Box 5668 Cleveland, Ohio 44101	do	Lawrence.
Medusa Portland Cement Co.[3 4]	do	do	York.
National Portland Cement Co.[1]	1023 West St. George Ave. Linden, N.J. 07036	do	Northampton.
Penn-Dixie Cement Corp[5]	Box 152 Nazareth, Pa. 18064	do	Butler.

See footnotes at end of table.

Table 28.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Cement—Continued			
Penn-Dixie Cement Corp [1]	Box 152 Nazareth, Pa. 18064	Plant	Northampton.
Universal Atlas Cement Div., U.S. Steel Corp.	600 Grant St. U.S. Steel Bldg. Pittsburgh, Pa. 15230	do	Allegheny.
Universal Atlas Cement Div., U.S. Steel Corp.[1]	do	do	Northampton.
Whitehall Cement Manufacturing Co.[1]	123 South Broad St. Philadelphia, Pa. 19109	do	Lehigh.
Clay and shale:			
Fire:			
Drexel Refractories Div., Drexel Dynamics Corp.	Box 50 Kittanning, Pa. 16201	Underground	Armstrong.
Freeport Brick Co., Kittanning Brick Div.	R.D. 1 Adrian, Pa. 16120	do	Do.
Harbison Walker Refractories.	2 Gateway Center Pittsburgh, Pa. 15222	Pits	Cambria, Centre, Clearfield, Fayette, Somerset.
Clearfield Clay Prod. Co	Box 1110 Clearfield, Pa. 16830	3 mines	Clearfield.
Reese Brothers	Houtzdale, Pa. 16651	2 mines	Do.
Ralph A. Veon, Inc	Darlington, Pa. 16115	Pit	Lawrence.
Common clay and shale:			
Bylite Corp	Box 1628 North End Station Wilkes-Barre, Pa. 18705	Pit	Luzerne.
Glen-Gery Corp	227 North 5th St. Reading, Pa. 19601	Pit	Berks, Northumberland, Union, York.
Hanley Co	28 Kennedy St. Bradford, Pa. 16701	Pit	McKean and Jefferson.
McAvoy Vitrified Brick Co.	Phoenixville, Pa. 19460	Pit	Chester.
McQuiston Coal Co [6]	109 East Moody Ave. New Castle, Pa. 16101	Pit	Lawrence.
Milliken Brick Co., Inc	2100 Montier St. Pittsburgh, Pa. 15221	Pit	Allegheny.
Coal:			
Anthracite:			
Blue Coal Corp [4]	101 South Main St. Ashley, Pa. 18706	Underground	Luzerne.
Blue Coal Corp [7]	do	Culm bank	Do.
Blue Coal Corp [8]	do	Strip	Do.
Gilberton Coal Co	Gilberton, Pa 17934	Culm bank	Northumberland.
Glen-Nan Coal Co., Inc	St. Mary's and River Rd. Wilkes-Barre, Pa. 18702	Underground	Luzerne.
Greenwood Stripping Corp.	1 Venice St. Nesquehoning, Pa. 18240	Strip	Carbon, Schuylkill.
Jeddo-Highland Coal Co.[8]	800 Exeter Ave. West Pittston, Pa. 18643	do	Luzerne.
Jeddo-Highland Coal Co.[4]	do	Culm bank	Do.
Kerris & Helfrick, Inc	Lehigh and Popular St. Mount Carmel, Pa. 18751	Strip	Columbia, Northumberland, Schuylkill.
Leon E. Kocher Coal Co	Box 127 Valley View, Pa. 17983	Underground	Schuylkill.
Lehigh Valley Anthracite, Inc.	800 Exeter Ave. West Pittston, Pa. 18653	Culm bank	Carbon, Schuylkill, Luzerne.
Do	do	Strip	Columbia, Luzerne, Schuylkill.
Reading Anthracite Co	200 Mahantongo St. Pottsville, Pa. 17901	Culm bank	Northumberland, Schuylkill.
Do	do	Strip	Do.
Bituminous:			
Barnes & Tucker Co	357 Lancaster Ave. Haverford, Pa. 19041	Underground	Cambria.
Bethlehem Mines Corp	701 East 3d St. Bethlehem, Pa. 18016	do	Cambria, Washington.
Buckeye Coal Co	Box 900 Youngstown, Ohio 44501	do	Greene.
Gateway Coal Co., for J & L Steel Corp.	Box 608 California, Pa. 15419	do	Do.
Harmar Coal Co [4]	Box 500 Library, Pa. 15129	do	Allegheny.

See footnotes at end of table

Table 28.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal—Continued			
Bituminous—Continued			
Jones & Laughlin Steel Corp.	Box 608 California, Pa. 15419	Underground	Greene.
Mathies Coal Co	Box 500 Library, Pa. 15129	do	Washington.
Pittsburgh Coal Co [4]	do	do	Do.
United States Steel Corp.	525 Wm. Penn Pl. Pittsburgh, Pa. 15219	do	Do.
Graphite (synthetic):			
Airco Speer Carbon Products, Div. of Air Reduction Co., Inc.	Theresia St. St. Marys, Pa. 15857	Plant	Elk.
Chas. Pfizer & Co., Inc. MPM Division.	235 East 42d St. New York, N.Y. 10017	do	Northampton.
Stackpole Carbon Co	St. Marys, Pa. 15857	do	Elk.
Gypsum (calcined): United States Gypsum Co.[9]	101 South Wacker Dr. Chicago, Ill. 60606	do	Philadelphia.
Iron ore:			
Bethlehem Mines Corp [10]	701 East 3d St. Bethlehem, Pa. 18016	Underground	Berks.
Bethlehem Mines Corp [11]	do	do	Lebanon.
Iron oxide pigments:			
Crude:			
Allegheny Ludlum Steel Corp.	2000 Oliver Bldg. Pittsburgh, Pa. 15222	Plant	Allegheny.
Lanzendorfer Minerals Co.	Twin Rocks, Pa. 15960	Pit	Cambria.
Finished:			
Minerals, Pigments & Metals Div., Chas. Pfizer & Co., Inc.	640 North 13th St. Easton, Pa. 18042	Plant	Northampton.
The Prince Manufacturing Co.	Bowmanstown, Pa. 18030	do	Carbon.
Reichard-Coulston, Inc.	15 East 26th St. New York, N.Y. 10010	do	Northampton.
Lime:			
The J. E. Baker Co [1]	Box 1189 York, Pa. 17405	do	York.
Mercer Lime & Stone Co	1640 Oliver Bldg. Pittsburgh, Pa. 15222	do	Butler.
National Gypsum Co [1]	325 Delaware Ave. Buffalo, N.Y. 14202	do	Centre.
Warner Co [1]	1721 Arch St. Philadelphia, Pa. 19103	do	Centre, Chester.
Mica (crude): Micalith Mining Co., Inc.	Box 16148 Phoenix, Ariz. 85001	Pit	York.
Peat:			
Benton Peat	Benton, Pa. 17814	Bog	Columbia.
Blue Ridge Industries, Inc.	Box 128, R.D. 2 White Haven, Pa. 18661	Bog	Luzerne.
D.M. Boyd Co	226 Francis St. New Wilmington, Pa. 16142	Bog	Lawrence.
Corry Peat Products Co	515 West Columbus Ave. Corry, Pa. 16407	Bog	Erie.
International Peat, Inc	R.D. 1 White Haven, Pa. 18661	Bog	Luzerne.
Lake Benton Peat Moss	1418 North Main St. Scranton, Pa. 18508	Bog	Lackawanna.
Pennsylvania Peat Moss, Inc.	21st and Laurel Sts. Hazleton, Pa. 18201	Bog	Luzerne, Monroe.
Stillers Blue Ridge Peat Co	R.D. 1 White Haven, Pa. 18661	Bog	Luzerne.
Perlite (expanded):			
Armstrong Cork Co	Lancaster, Pa. 17603	Plant	Lancaster.
Atlantic Perlite	Box 345 Primose, Pa. 19018	do	Delaware.
Pennsylvania Perlite Corp	Box 2002 Lehigh Valley, Pa. 18001	do	Lehigh, York.
Perlite Manufacturing Co	Box 478 Carnegie, Pa. 15106	do	Allegheny.
U.S. Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Philadelphia.
Petroleum refineries:			
Atlantic Richfield Co	260 South Broad St. Philadelphia, Pa. 19102	do	Do.
BP Oil Corp	600 Fifth Ave. New York, N.Y. 10001	do	Delaware.
Gulf Oil Corp	Box 7408 Philadelphia, Pa. 19101	do	Erie.
Kendall Refining Co., Div. of Witco Chemical Co.	Bradford, Pa. 16701	do	McKean.
Pennzoil United, Inc	Oil City, Pa. 16301	do	Venango.

See footnotes at end of table.

Table 28.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Petroleum refineries—Continued			
Quaker State Oil Refining Corp.	Farmers Valley, Pa. 16749	Plant	McKean, Venango.
Sun Oil Co	1608 Walnut St. Philadelphia, Pa. 19101	do	Do.
United Refining Co	Warren, Pa. 16365	do	Warren.
Valvoline Oil Co., Div. of Ashland Oil and Refining Co.	Freedom, Pa. 15042	do	Beaver.
Wolf's Head Oil Refining Co., Inc.	Reno, Pa. 16343	do	Venango.
Sand and gravel:			
Davison Sand & Gravel Co	34th Ave. and 4th St. New Kensington, Pa. 15068	Dredge	Westmoreland.
Dravo Corp. Keystone	One Oliver Plaza Pittsburgh, Pa. 15222	do	Beaver.
Erie Sand Steamship Co	Erie, Pa. 16500	do	Erie.
Haudaille Constr. Materials Inc.	10 Park Place Morristown, N.J. 07960	Pit	Northampton.
Lycoming Silica Sand Co	401 Broad St., Box 159 Montoursville, Pa. 17754	Pit	Lycoming.
Mahoning Valley Sand Co	Box 1236 New Castle, Pa. 16102	Pit and plant	Lawrence.
Pennsylvania Glass Sand Corp.	Berkeley Springs, W. Va. 25411	Pit	Huntingdon, Mifflin, Venango.
Pennsy Supply, Inc	1001 Paxton St. Harrisburg, Pa. 17104	Pit	Perry.
Warner Co	1721 Arch St. Philadelphia, Pa. 19103	Pit	Bucks.
Wyoming Sand and Stone Co.	Falls, Pa. 18615	Pit	Wyoming.
Smelters:			
The New Jersey Zinc Co	Palmerton, Pa. 18071	Plant	Carbon.
St. Joe Minerals Corp	Josephtown, Pa. 15061	do	Beaver.
Stone:			
Limestone and dolomite—crushed:			
Appalachian Stone Div., Martin-Marietta Corp.	Box 120 Mercersburg, Pa. 17236	Quarry	Centre, Chester, Fayette, Franklin.
Bethlehem Mines Corp.	701 East 3rd St. Bethlehem, Pa. 18016	do	Adams.
Do	do	do	Mifflin, Montgomery, Northampton.
Bradford Hills Quarries, Inc.	Box 231 Easton, Pa. 18042	do	Chester, Lancaster, Perry.
G. & W. H. Corson, Inc.[12]	Plymouth Meeting, Pa. 19462	do	Montgomery.
Eureka Stone Quarry, Inc.	Lower State and Pickertown Rds. Eureka, Pa. 18914	do	Bucks.
Eastern Industries, Inc	Box 188 Wescosville, Pa. 18090	do	Berks, Lehigh.
Lycoming Silica Sand Co.	Box 159 Montoursville, Pa. 17754	do	Columbia, Lycoming, Montour.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Berks, Centre, York.
New Enterprise Stone & Lime.	New Enterprise, Pa. 16664	do	Bedford, Blair, Franklin, Huntingdon.
United States Steel Corp.	Hillsville, Pa. 16132	do	Lawrence.
Miscellaneous—crushed and broken: Gill Quarries, Inc.	Box 187 Fairview Village, Pa. 19434	do	Montgomery.
Sandstone and quartzite—crushed:			
American Asphalt Paving Co.	Box 95, R.D. 5 Shavertown, Pa. 18700	do	Luzerne.
Coolbaugh Sand & Stone, Inc.	32 Railroad Ave. Scranton, Pa. 18505	do	Do.
Faylor Middlecreek, Inc.	Winfield, Pa. 17889	do	Dauphin, Northampton.
Keeler Supply Co., Inc.	Box 12 Clifford, Pa. 18413	do	Susquehanna.
Latrobe Construction Co	Box 150 Latrobe, Pa. 15650	Underground	Westmoreland.
No. 1 Contracting Corp. of Delaware.	Box 460 Pittston, Pa. 18640	Quarry	Northampton, Schuylkill.
Summit Quarries, Div. of J. Robert Bazley, Inc.	Box 298 Pottsville, Pa. 17901	do	Schuylkill.

See footnotes at end of table.

Table 28.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Sandstone and quartzite—dimension:			
Delaware Quarries	Lumberville, Pa. 18933	Quarry	Bucks.
Firestone Products Co., Inc.	300 Willow Grove Ave. Glenside, Pa. 19038	do	Montgomery.
Media Quarry Co	131 East 2d St. Media, Pa. 19063	do	Delaware.
Slate—dimension:			
Anthony Dally & Sons, Inc.	Robinson Ave. Pen Argyl, Pa. 18072	do	Northampton.
Doney Slate Co	Pen Argyl, Pa. 18072	do	Do.
Emerald Slate Corp	Alpha Road Wind Gap, Pa. 18091	do	Do.
North Bangor Slate Co.	Bangor, Pa. 18013	do	Do.
Penn Big Bed Slate Co., Inc.	446 Main St. Slatington, Pa. 18080	do	Lehigh.
Stephens-Jackson Co	Main St. and Schanck Ave. Pen Argyl, Pa. 18072	do	Northampton.
D. Stoddard & Sons, Inc	Bangor, Pa. 18013	do	Do.
Traprock (basalt)—crushed and broken:			
Bucks County Crushed Stone, Inc.	Ottsville, Pa. 18952	do	Bucks.
V. Di Francesco & Sons	17 Mifflin Ave. Havertown, Pa. 19083	do	Chester.
Do	do	do	Delaware.
The General Crushed Stone Co.	712 Drake Bldg. Easton, Pa. 18042	do	Bucks, Delaware.
Kibblehouse Quarries, Inc.	Perkiomenville, Pa. 18074	do	Montgomery.
Pottstown Trap Rock Quarries, Inc.	R.D. 1 Douglasville, Pa. 19518	do	Berks, Montogemry.
Warner Co	1721 Arch St. Philadelphia, Pa. 19103	do	Berks.
Traprock (basalt)—dimension:			
Coopersburg Granite Co	Coopersburg, Pa. 18036	do	Bucks.
Granite—crushed:			
Mignatti Construction Co., Inc.	2310 Terwood Ave. Bethayres, Pa. 19006	do	Montgomery.
Sulfur:			
Atlantic Richfield Co	3144 Passyunk Ave. Philadelphia, Pa. 19145	Plant	Philadelphia.
Gulf Oil Corp	Box 7408 Philadelphia, Pa. 19101	do	Do.
BP Oil Corp., Subsidiary of British Petroleum Corp., Ltd.	Box 428 Marcus Hook, Pa. 19061	do	Delaware.
Sun Oil Co	1608 Walnut St. Philadelphia, Pa. 19103	do	Do.
Tripoli (rottenstone):			
Keystone Filler & Manufacturing Co.	Muncy, Pa. 17756	Pit	Lycoming.
Penn Paint & Filler Co	Antes Fort, Pa. 17720	Pit	Do.
Vermiculite (exfoliated):			
Hyzer & Lewellen	Box 155 Southhampton, Pa. 18966	Plant	Bucks.
W. R. Grace & Company, Construction Prod. Div.	62 Whittemore Ave. Cambridge, Mass. 02140	do	Lawrence.

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[1] Also limestone.
[2] Also limestone and shale.
[3] Also limestone and clay.
[4] 2 operations.
[5] Also limestone and sand and gravel.
[6] Also fire clay.
[7] 3 operations.
[8] 4 operations.
[9] Also expanded perlite.
[10] Also byproduct cobalt and pyrites.
[11] Also byproduct gold, silver, copper, cobalt, and pyrites.
[12] Also lime.

The Mineral Industry of Puerto Rico, the Panama Canal Zone, the Virgin Islands, Pacific Island Possessions, and Trust Territory of the Pacific Islands

The Puerto Rico Section of this chapter was prepared with cooperation of the Bureau of Mines, U.S. Department of the Interior, the Mining Commission of Puerto Rico, and the Economic Development Administration (Fomento) Commonwealth of Puerto Rico.

By J. M. West [1] and Sarkis G. Ampian [2]

PUERTO RICO [3]

Outputs of cement and sand and gravel declined in 1972, but most other mineral production activities continued to expand. Petrochemicals contributed increasingly to the Island's income from petroleum processing.

During 1972, two events occurred that will have both long- and short-term implications on future mineral resource related policies in Puerto Rico. The first was the creation of a Department of Natural Resources (DNR) by legislation signed on June 20, 1972. The act consolidates most executive branch responsibilities relating to natural resources, including the Mining Commission, into the new DNR, which will come into being on January 3, 1973. The second event was the return to power in the November elections of the Popular Democratic Party (PDP), which is a Puerto Rican counterpart to the U.S. Democratic Party. Rafael Hernandez Colon, 36 years old, was elected Governor by a substantial margin over the incumbent, industrialist Luis A. Ferré.

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[2] Physical scientist, Division of Nonmetallic Minerals.

[3] Prepared by J. M. West.

Table 1.—Mineral production in Puerto Rico [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement, portland ....thousand short tons..	2,001	$38,413	1,946	$31,756
Clays ....do....	342	358	361	382
Lime ....do....	44	W	42	1,776
Salt ....do....	29	570	29	580
Sand and gravel ....do....	r 12,998	r 34,980	p 7,478	p 21,237
Stone ....do....	12,130	29,847	13,504	32,793
Total	XX	r 2 104,168	XX	p 88,524
Total 1967 constant dollars	XX	88,574	XX	p 73,643

p Preliminary. r Revised. W Withheld to avoid disclosing individual company confidential data.
XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Total does not include value of items withheld.

Table 2.—Value of mineral production in Puerto Rico, by district

(Thousands)

Senatorial district	1971	1972	Minerals produced in 1972 in order of value
Aguadilla	$2,741	$2,769	Sand and gravel.
Arecibo	r 4,210	4,207	Do.
Guayama	1,537	1,552	Do.
Humacao	1,610	1,626	Do.
Mayaguez	3,722	3,922	Sand and gravel, salt, stone.
Ponce	29,017	24,104	Cement, sand and gravel, stone, clays.
San Juan	r 33,366	20,043	Cement, stone, sand and gravel, clays.
Various [1]	27,966	30,301	
Total	r [2] 104,168	p 88,524	

r Revised. p Preliminary.
[1] Includes stone that cannot be assigned to specific districts.
[2] Data does not add to total shown because of independent rounding.

Despite further negotiating sessions between copper mining companies and Puerto Rican officials, an impasse continued over the proposed development of several central Puerto Rican porphyry copper deposits. The copper firms presented new project cost estimates, dated February 1972, that showed production costs up 20% over 1969 estimates. Future negotiating responsibilities will shift from the Mining Commission to the Secretary of the new DNR.

At the end of 1972, the Mining Commission of Puerto Rico reported eight exclusive exploration permits in effect. Details concerning the permits are shown in table 3.

Table 3.—Exclusive prospecting permits in Puerto Rico

(December 31, 1972)

Permit holder	Date	Parent company	Minerals
Weaver Oil & Gas Corp	Aug. 20, 1968		Gas and oil.
Puerto Rico Petroleum Exploration Corp	July 14, 1968		Do.
Oceanic Exploration Co	Sept. 24, 1971	Eastman Dillon Union Securities & Co., Inc	Do.
Cobre Caribe, S.A.[1]	Aug. 5, 1958	Kennecott Copper Corp	Do.
Ponce Mining Co.[1]	May 15, 1961	American Metal Climax, Inc	Do.
Anthony Rojas	Oct. 27, 1970		Do.
Oceanic Exploration Co	Oct. 27, 1970	Eastman Dillon Union Securities & Co., Inc	Do.
Parnasse Co	Oct. 27, 1971	Parnasse Delaware Co	Do.

[1] Application has been made for a mining lease.

The recently created (June 1970) Environmental Quality Board (EQB) published comprehensive annual reports on its first 2 years of activities, which were closely coordinated with and paralleled the programs of the Federal Environmental Protection Agency.[4] Environmental Quality Board priority has been established in implementing the requirement that Environmental Impact Statements be prepared on all proposed governmental actions that could significantly affect the environment.

Industrial Siderurgica, Inc., Puerto Rico's only steel producer, did not complete its expansion program. Automation and modernization of this scrap-based plant to double capacity from 50,000 to 100,000 tons per year was expected to be finished about yearend 1973.

Government Programs.—The Geological Laboratory of Natural Resources completed its third year of operation. The Laboratory is operated jointly by the Puerto Rican Area of Natural Resources (ANR), Department of Public Works, and the U.S. Geological Survey (USGS). In April 1972, the chief of the ANR Laboratory and USGS scientist coauthored a paper illustrating the use of gold in soil sampling as an indicator of both primary and supergene-enriched porphyry copper deposits.[5]

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[4] Environmental Quality Board. Environmental Report-1971. May 1971, 112 pp.
Environmental Quality Board. Environmental Report-1972. April 1972, 71 pp.

[5] Learned, R. E., and R. Boissen. Gold-A Useful Pathfinder Element in the Search for Porphyry Copper Deposits in Puerto Rico. Inst. Min. and Met. (London), Proc. 4th Internat. Geochem. Exploration Symp., 1973, pp. 93-103.

During the year personnel from this laboratory also traveled to Brazil where they assisted in establishing laboratories in Rio de Janeiro.

A joint USGS-ANR geochemical survey was conducted on the island of Vieques. Numerous anomalous areas of copper were discovered but none appeared to be of economic interest.

U.S. Geological Survey scientists continued their cooperative Environmental Geology project with the Commonwealth Government. The joint program will be continued in 1973 with the new Department of Natural Resources to assist its geologists in improving technical capabilities. Chief products of this program will be large-scale (1:20,000) general-purpose geologic maps on a 7½-minute quadrangle base. Geological maps have been published for 31 out of 65 quadrangles for all of Puerto Rico. Field work was completed and maps and reports were in preparation for 13 other quadrangles; field work was in progress on nine others. During 1972, the group released various publications[6] and open-file reports.[7] (Cited U.S. Geological Survey Open-File Reports are available for inspection at Room 1033 of the General Services Administration Building, U.S. Geological Survey Library, Washington, D.C. and the U.S. Geological Survey Field Office, San Juan, P.R.) Plans for the future included additional products from the basic geological data. These would emphasize environmental and land resource aspects of the geology.

Hydrological projects were continued in 1972 by the Caribbean District of the Water Resources Division of the U.S. Geological Survey. In 1972 the Caribbean District issued eight publications.[8] Also, studies were in progress in the Rio Maunabo basin, southeast Puerto Rico; the Lajas Valley, southwest Puerto Rico; and in the San Juan metropolitan area. A water resources planning model was started for Puerto Rico incorporating economic, population, and other data in addition to basic water resource information.

REVIEW BY MINERAL COMMODITIES

Nonmetals.—*Cement.*—Despite the fact that construction activity increased in 1972, 2% less cement was manufactured by the Islands' two producers in 1972. Cement prices increased twice during 1972. Each was a 5-cent-per-bag increase, which brought producer prices at yearend to $1.40 per bag.

The major producer, Puerto Rican Cement Co., Inc., reported modest increases in earnings but a 4% decline in total cement sales.[9] Several strikes and production problems at the firm's San Juan and Poncé plants caused the decline. Despite this, Puerto Rican Cement produced about 80% of the island output. Also, the company produced 96,000 tons of ready-mix mortar, about 6,000 tons more than in 1971.

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[6] Pease, M. N., and R. P. Briggs. Geologic Map of the Rio Grande Quadrangle, Puerto Rico. Misc. Geol. Inv. Map No. I-733, U.S. Geol. Survey, 1972.

Seiders, V. M., R. P. Briggs, and L. Glover III. Geology of Isla Desecheo, Puerto Rico, With Notes on the Great Southern Puerto Rico Fault Zone and Quaternary Stillstands of the Sea. U.S. Geol. Survey Prof. Paper 739, 1972, 22 pp.

Briggs, R. P. The Lower Cretaceous Figuera Lava and Fajardo Formation in the Stratigraphy of Northeastern Puerto Rico. U.S. Geol. Survey Bull. 1372-G, 1972, 10 pp.

McIntyre, D. H., and J. M. Aaron. Possible Subaerial Outcropping of Horizon "A", Northwestern Puerto Rico. Trans. 6th Caribbean Geol. Conf., San Juan, 1972, p. 132.

[7] Monroe, W. H. Geology of the Middle Tertiary Rocks in the Ponce-Guanica Area-a Progress Report. U.S. Geol. Survey Open-File Report, 1972, 27 pp.

Krushensky, R. D. Geologic Map of the Pone Quadrangle, Puerto Rico. U.S. Geol. Survey Open-File Report, 1972, 36 pp.

McIntyre, D. H. Geologic Map of the Maricao Quadrangle, Puerto Rico. U.S. Geol. Survey Open-File Report, 1972, 36 pp.

Hooker, M. References on the Geology of Puerto Rico Supplementary to the Bibliography and Index of the Geology of Puerto Rico and Vicinity, 1866–1968. U.S. Geol. Survey Open-File Report, 1972, 36 pp.

Griscom, A. Complete Bouguer Gravity Map of Eastern Puerto Rico and Principal Facts for Gravity Stations. U.S. Geol. Survey Open-File Report, 1972, 4 pp.

[8] Bennett, G. D., and Guisti, E. V. Ground Water in the Tortuguero Area, Puerto Rico. Puerto Rico Water Res. Bull. 10, 1972, 25 pp.

Bennett, G. D. Ground Water Along Rio Bucana at Ponce, Puerto Rico Water Res. Bull. 11, 1972, 28 pp.

Cosner, O. J. Water in St. John, U.S. Virgin Islands, Caribbean District. Open-File Rept. 1972, 46 pp.

Haire, W. J. Flooding Along the Rio Piedras in the San Juan Area, Puerto Rico. Caribbean District Open-File Rept. Map Series No. 1.

———. Floods in the Rio Guanajibo Valley, Southwestern Puerto Rico. Hydro. Inv. Atlas HA-456, 1972.

Johnson, K. G. Floods in the Aguadilla-Aguada Area, Northwestern Puerto Rico. Hydrol. Inv. Atlas HA-457, 1972.

McClymonds, N. E., and J. R. Diaz. Water Resources of the Jobos Area, Puerto Rico. Puerto Rico Water Res. Bull. 13, 1972, 32 pp.

Robison, T. M. Ground Water in Central St. Croix, U.S. Virgin Islands. Caribbean District, Open-File Rept. 1972, 18 pp.

[9] Puerto Rican Cement Co., Inc., Annual Report, 1972. P. 4.

The newest producer, San Juan Cement Co., increased output a few percent during its second complete year of operation. Installation of the third kiln to expand capacity by 5,000 barrels per day was delayed and was rescheduled for about yearend 1973.

Table 4.—Puerto Rico: Portland cement salient statistics

(Thousand short tons and thousand dollars)

	1971	1972
Number of active plants	3	3
Rated capacity, Dec. 31	r 2,256	2,256
Production	r 1,992	1,969
Shipments from mills:		
Quantity	r 2,001	1,946
Value	38,413	31,756
Stocks at mills, Dec. 31	r 26	39

r Revised.

Graphite.—Union Carbide Corp. used petroleum coke from its Peñuelas operations to produce synthetic graphite electrodes.

Lime.—Puerto Rican Cement Co., Inc., reported that its lime plant operated near capacity in 1972. Further expansion of lime production in 1973 was anticipated since the firm's white cement plant was being converted to production of hydrated lime and gray cement.

Vermiculite.—The Zonolite Division of W. R. Grace & Co. operated a plant at Aguadilla for exfoliation of vermiculite.

Construction Materials.—As shown in table 5, the overall expansion of the construction industry continued in 1972, but the outlook was clouded for 1973 because of the Federal Government's 1972 freeze on housing funds.

Metals.—*Copper.*—Negotiations that could lead to a 48,000-ton-per-year copper industry based on central Puerto Rican deposits were continued in 1972 with no conclusive agreements.[10]

Nickel.—During the first half of 1972, a Mining Commission geologist, in cooperation with the Public Works Department's Area of Natural Resources scientists, conducted a geological investigation on the Guanajibo lateritic nickel deposit south of Mayaguez. The program included 545 feet (12 holes) of rotary drilling. A comprehensive report on this investigation concluded that the commercial value of the deposit, the mineralized zones of which averaged about 1.2% nickel, might range

Table 5.—Construction activity in Puerto Rico

(Million dollars)

Type of construction	1970 [1]	1971 [1] r	1972 [1]
Dwellings:			
Private	276.3	295.3	348.1
Public	60.3	97.0	104.1
Total	336.6	392.3	452.2
Industrial and commercial:			
Private	343.9	391.0	314.0
Public	r 157.2	195.8	272.0
Total	r 501.1	586.8	586.0
Roads, schools, other public works:			
Puerto Rican Government	r 140.1	148.1	244.7
Municipalities	15.9	21.0	21.9
Total	r 156.0	169.1	266.6
Grand total	[2] 993.8	1,148.2	1,304.8

r Revised.
[1] Fiscal year—July 1 to June 30.
[2] Data does not add to total shown because of independent rounding.

Source: Puerto Rico Planning Board.

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[10] Engineering & Mining Journal. Puerto Rican Copper Still Subject of Negotiations. V. 173, No. 9, September 1972, p. 130.

Table 6.—Puerto Rico: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	r 3,757	r 10,138	2,323	6,071
Fill	r 1,394	r 1,720	657	714
Paving	r 2,680	r 6,725	1,147	3,052
Total [1]	r 7,831	r 18,583	4,128	9,837
Gravel:				
Building	r 2,426	r 8,771	2,011	7,280
Fill	r 930	r 1,165	258	328
Paving	r 1,581	r 5,677	849	3,004
Total [1]	r 4,937	r 15,613	3,118	10,608
Government-and-contractor operations:				
Sand:				
Building	r 189	r 638	190	644
Paving	41	146	42	148
Total	r 230	r 784	232	792
Total sand and gravel	r 12,998	r 34,980	7,478	21,237

r Revised.
[1] Data may not add to totals shown because of independent rounding.

Table 7.—Puerto Rico: Stone sold or used by producers

(Thousand short tons and thousand dollars)

Year	Dimension limestone		Crushed limestone	
	Quantity	Value	Quantity	Value
1968	101	293	5,619	9,408
1969	101	292	5,238	9,380
1970	101	292	5,549	9,777
1971	142	441	9,662	15,856
1972	139	426	10,194	17,033
	Miscellaneous stone [1]		Total	
	Quantity	Value	Quantity	Value
1968	1,647	3,879	7,367	13,580
1969	1,646	3,878	6,985	13,550
1970	1,646	3,878	7,296	13,947
1971	2,326	13,550	12,130	29,847
1972	3,171	15,333	13,504	[2] 32,793

[1] Includes granite (1968–70), marble, and traprock (1971, 1972), and other stone.
[2] Data does not add to total shown because of independent rounding.

from $225 to $725 million.[11] An additional drilling program was recommended.

Mineral Fuels.—Imports of crude and unfinished oil as feedstock to refiners and petrochemical producers increased 24% from those in 1971 and averaged 335,900 barrels per day. Residual fuel oil and finished products amounting to 2,503 barrels per day were also imported during the year for direct consumption. During fiscal year 1972 imports of petroleum, natural gas, and related products from foreign countries and the Virgin Islands were valued at $278.4 million. Various petroleum and related organic chemical products valued at $42.1 million were shipped to Puerto Rico from the United States during the same period. The United States was the destination for $255.0 million worth of various products, including $98.2 million in natural gasoline and blending agents. $56.8 million in distillate fuel oils, $28.6 million in organic chemicals, $27.0 million in mineral tar and crude chemicals from petroleum, and $24.3 million in ethyl alcohol. Shipments to other destinations were valued at $40.2 million, over half in organic chemicals. Export values in fiscal 1972 were up 30% from those a year earlier.

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[11] Cram, Carlos M. Estudio Preliminar de Geologia Economica del Yacimiento Niquelifero del Barrio Guanajibo de Cabo Rojo. Puerto Rico, Mining Commission Staff Report, June 26, 1972, 45 pages plus geological map. (Copies in Spanish may be obtained from the Mining Commission, Commonwealth of Puerto Rico, GPO Box 3088, San Juan, P.R. 00936.)

Petrochemicals.—Commonwealth Oil Refining Co., Inc. (CORCO), the Islands largest refiner and petrochemical processor, reported processing in 1972 a total of 60 million barrels of crude and other feedstocks valued at $179.6 million, which compared with 56.8 million barrels valued at $155.7 million in 1971.[12] CORCO began receiving modest amounts of Algerian crude oil and condensate in the second half of 1972 as a result of contracts with Sonatrach, the Algerian Government's oil-producing agency. Delays were experienced due to Algerian production problems, which were expected to reflect in reduced availability of heating oils to Puerto Rico markets in early 1973. Increasing quantities of the low-sulfur Algerian imports were planned in order to meet new regulations issued by the Puerto Rico Environmental Quality Board.

Modifications were made in CORCO's refining facilities at Peñuelas, west of Poncé, to permit processing of 35,000 barrels per day of Algerian feedstocks, increasing overall capacity about 30%. Together with existing capacities of the Caribbean Gulf Refining Corp. at Bayamon and Puerto Rico Sun Oil Co. at Yabucoa, the Island's refiners had a total yearend capacity estimated at 250,000 barrels per day. Table 8 shows involvement of the various major companies in the Puerto Rican petrochemical industry. Besides basic refining, CORCO maintained a 50% interest in five joint petrochemical ventures: Hercor Chemical Corp., Shell and Commonwealth Chemicals, Inc. Oxochem Enterprise, Puerto Rico Olefins Co., and Puerto Rico Olefins, Inc.

Union Carbide Caribe, Inc., completed a butadiene plant and units for making olefins, ethylene oxide, and polyethylene at Peñuelas in February 1972, and later in the year began operations of units at the same location for making ethylbenzene, glycol ethers, and phenol, acetone, and bisphenol products. PPG Industries completed a chlorine and caustic soda plant in March 1972 at Guayanilla and followed this with completion of units for making ethylene oxide and glycols and ethylene dichloride. PPG Industries also completed a vinyl chloride monomer plant at Guayanilla early in 1972. Fibers International Corp. began operation of a nylon carpet yarn plant at Guayama in June 1972 utilizing petrochemicals from the Poncé area.

Union Carbide's estimated $300 million venture in Puerto Rican petrochemicals was reported to have the following capacities, in million pounds: Ethylene, 775; ethylene oxide, 450; ethylene and triethy-

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[12] Commonwealth Oil Refining Co. Inc. Annual Report 1972. 24 pp.

Table 8.—Refining and petrochemical industry in Puerto Rico [1]

Basic producers	Principal intermediate producers	Producers of semifinished products
Petroleum refiners:	*Petrochemical processors:*	
Commonwealth Oil Refining Co. Inc. (CORCO)	Union Carbide Caribe, Inc.	Reichhold Chemical del Caribe, Inc.
Puerto Rico Sun Oil Co. (Sun Oil Co.)	Phillips Core, Inc.	International Corry Foam Products (Firestone Foam & Rubber Products Div.)
Carribbean Gulf Refining Corp. (Gulf Oil Corp.)	Oxochem Enterprise (CORCO—W. R. Grace & Co.)	Fibers International Corp. (Phillips Petroleum Co.)
Basic petrochemical producers:	PPG Industries	Union Carbide Caribe, Inc.
Commonwealth Petrochemicals, Inc. (CORCO)	Shell and Commonwealth Chemicals, Inc. (SACCI)	
Puerto Rico Olefins Co. (CORCO—PPG Industries, Inc.)	Puerto Rico Chemical Co. (Hooker Chemical Corp.)	
Phillips Core, Inc.	Styrochem Corp. (CORCO)	
Union Carbide Caribe, Inc.	*Chlor-alkali processor:*	
Peerless Petrochemicals (P.R.) Inc. (Peerless Oil and Chemical Corp.)	PPG Industries	
Hercor Chemical Corp. (CORCO—Hercules, Inc.)		
Basic chlor-alkali producer:		
PPG Industries, Inc. (PPG)		

[1] Based on reports of Economic Development Administration, Commonwealth of Puerto Rico, February and May 1973.

lene glycols, 630; LD polyethylene, 300; propylene, 360; cumene, 640; phenol, 200; acetone, 120; bisphenol-A, 70; and butadiene, 60.[13] About yearend, plans were announced for a joint venture between CORCO and a combine of Japan's Mitsubishi Corp. and Nippon Zeon Co. to build an $11 million plant producing isoprene monomer, a rubber substitute, at CORCO's complex west of Poncé.[14]

PANAMA CANAL ZONE [15]

Mineral production ceased in the Panama Canal Zone in 1971. The Republic of Panama supplied the sand and gravel, basalt, and andesite used as aggregate in concrete, roadstone, railroad ballast, and riprap. Most of the construction work, with the exception of routine maintenance by the Panama Canal Co. was performed by local contractors.

VIRGIN ISLANDS [16]

The U.S. Virgin Islands, located in the Caribbean, consist of about 50 islands of volcanic origin. St. Croix, St. Thomas, and St. John are the main islands. Most of the population and commercial activity of the Virgin Islands is centered on these three large islands.

Mineral production consisted chiefly of basalt, a traprock, which is crushed for use in concrete and asphalt aggregate, or roadstone. Caribbean Material Supply Co., Springfield Crusher Division of Masonry Products, Inc., and St. Croix Sand and Gravel Co. (a new producer), on St. Croix, and Controlled Concrete Inc. on St. Thomas, accounted for the total production. Output in 1972 increased 34% over that produced in 1971. Construction projects, brought about largely by the increasing number of tourists and a continuing population growth, continued to lead the way. An accelerated highway construction program, due in part to eligibility in 1971 for Federal Highway funds, was continuing. Low-cost public housing construction in cooperation with HUD programs, ongoing during 1971, was also continued in 1972.

Table 9.—Production of traprock in the Virgin Islands [1]

(Short tons)

1971		1972	
Quantity	Value	Quantity	Value
[r] 542,758	W	726,088	$2,255,048

[r] Revised. W Withheld to avoid disclosing individual company confidential data.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

The sewage system and treatment facility for St. Croix started in 1971 was completed during the year. The St. Thomas sewage and treatment plants, also started in 1971, were scheduled for completion in 1973. The Virgin Island Water and Power Authority has awarded Envirogenics Co. a $6.5 million contract to build desalting plants on St. Croix and St. Thomas. Each plant was planned to produce 2.25 million gallons per day of fresh water. Startup of the plants was scheduled for the first half of 1974. The two plants were to be located adjacent to the St. Croix and St. Thomas power station, to take advantage of the availability of low-cost turbine exhaust as the source of heat for distillation.[17]

The Hess Oil Virgin Islands Corp. (Amerada Hess) announced long-range plans for expanding its 450,000-barrel-per-day refinery to 800,000 barrels-per-day.[18] In 1971 capacity of the refinery near St. Croix was 250,000 barrels-per-day.

At yearend, the Virgin Islands Legislature was considering the desirability of approving plans to permit Virgin Islands Refining Corp. (VIRCO) to build a second major oil refinery on St. Croix. The new VIRCO 100,000-barrel-per-day refinery was assured a steady supply of low-sulfur crude by a subsidiary of Italy's state oil agency, Ente Nazionale Idrocarburi (ENI).[19] Martin Marietta Aluminum, Inc., of Martin Marietta Corp. announced increased alumina production from its St. Croix Bayer alumina plant, from Australian and Guyanan bauxites. Expansion of the St. Croix plant was currently underway to permit processing of higher quality bauxites from the Boké District of Guinea. Initial shipments of Boké bauxite were scheduled for delivery in late 1973. The alumina produced in St. Croix was shipped to company-owned reduction plants in Goldendale, Wash., and Dalles, Oreg.[20]

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[13] Chemical Marketing Reporter. Carbide Opens All the Taps at New Puerto Rico Complex; Olefins Unit Exceeds Capacity. V. 202, No. 21, Nov. 20, 1972, pp. 1, 17.

[14] Wall Street Journal. Commonwealth Oil Plans Puerto Rican Facility With Two Japanese Firms. V. 180, No. 113, Dec. 12, 1972, p. 8.

[15] Prepared by Sarkis G. Ampian.

[16] Prepared by Sarkis G. Ampian.

[17] Chemical Engineering. CPI News Brief. V. 79, No. 24, October 1972, p. 142.

[18] World Petroleum Report. Central America Section, 1973. P. 97.

Revocation of offshore sand dredging permits in 1971, prompted by the possible ecological damage to the Islands' beaches, were continued. The main islands, as in 1971, still had only a 6-month supply of building sand.

PACIFIC ISLAND POSSESSIONS[21]

REVIEW BY ISLANDS

American Samoa.—The Territory of American Samoa consists of seven islands in the South Pacific. The main island is Tutuila where the village of Pago Pago and the seat of government at Fagatogo are located. Tutuila contains over 80% of the Territory's population. Most of the Samoan mineral production is in Tutuila, mainly volcanic cinder and traprock. All production in 1972, less than in 1971, was by Government crews.

The cinder and rock were crushed to provide aggregate for cement and asphalt concrete. The pit-run cinder and rock were used in compacted fills, seawalls, roads, and road improvements. The Department of Public Works was constructing an 11-mile-long agricultural access road, using cinders from the Tau quarry, along the Tau mountain ridge to Fitiuta. The Department was also planning to use the Tau quarry cinders in the proposed Manua airstrip.

Guam.—Coral limestone was quarried and crushed in many municipalities throughout the Territory for aggregate use. The total output for 1972 increased 1% over that produced in 1971. Producers were Hawaiian Bitumuls and Paving Co., Ltd., and the Public Works Department of the Guam Government. Guam's economic upswing, attributed to the rapid growth of tourism and a growing population, led by construction projects, continues to set the pace, as in previous years.[22]

Kaiser Cement & Gypsum Corp. began construction of its $600,000 Cabras Island cement distribution plant in midyear. The enlarged facility was to have a storage capacity of 6,000 metric tons of cement, 5,000 square feet of warehouse for bagging and storage of sack cement, and modernized bulk truck-loading and transferring equipment.[23]

Wake.—The Wake Island group is a coral atoll consisting of Wake, Wilkes, and Peale Islands. Wake is the main island; Wilkes and Peale Islands contain only air

Table 10.—Mineral production in the Pacific Island Possessions [1]

(Short tons)

Area and mineral	1971		1972	
	Quantity	Value	Quantity	Value
American Samoa:				
Volcanic cinder	10,052	$35,132	--	--
Limestone	88,036	29,789	48,703	$418,976
Total	XX	64,921	XX	418,976
Guam: Limestone	718,495	1,705,167	831,234	1,982,778
Wake: Limestone	3,165	15,825	--	--

XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

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[19] Lardner, G., Jr. Oil Invasion of Virgin Isles Intensifies Growing Pains. Washington Post, Dec. 31, 1972, p. A-12.

[20] Martin Marietta Corp. Annual Report, 1972, pp. 11-13.

[21] Prepared by Sarkis G. Ampian.

[22] Territory of Guam. Fiscal Year 1972 Annual Report. Territory of Guam, pp. 19-30.

[23] Rock Products. Rock Newscope. V. 75, No. 4, April 1972, p. 17.

and sea navigation facilities. No coral limestone was recovered in 1972. Stockpiled crushed coral limestone was used chiefly in road maintenance during the year. Previously, coral limestone was recovered by clamshell draglines on Wake Island by the Federal Aviation Agency (FAA). The crushed limestone aggregate was used in concrete for new housing and rehabilitation of existing structures, and in asphalt for road improvements.

Wake Island was transferred to the Department of Defense on June 13, 1972. The future coral limestone demand is uncertain.

Other Pacific Island Possessions.—No mineral production was reported for the islands of Canton, Enderbury, Jarvis, Johnston, Midway, or Palmyra.

TRUST TERRITORY OF THE PACIFIC ISLANDS

Production of bauxite, manganese ore, limestone, and phosphate rock, notably from Babelthaup in the Palau District, has not been reported for years. The possibility of renewed production is considered negligible. Volcanic rock, for use as aggregate in concrete, was produced locally on many of the islands scattered throughout the islands of Micronesia. Continued small-scale production of aggregates for construction and a limited production of ceramic-grade clays will be the only materials mined in the Trust Territory in the foreseeable future.

The Mineral Industry of Rhode Island

By Frank B. Fulkerson [1]

Value of mineral production in Rhode Island in 1972 was $4.3 million, virtually identical with that of 1971. A value loss for stone was offset by increased value for sand and gravel. Sand and gravel and stone continued to be the only mineral commodities commercially produced in the State. A small quantity of gem stones was gathered by collectors.

Providence was the leading mineral-producing county, followed by Kent, Washington, and Newport. No mineral production was reported in Bristol County. Sand and gravel was produced in all four mineral-producing counties and was used for paving, building construction, fill, molding sand, and miscellaneous purposes. Granite and conglomerate were quarried and crushed for concrete and bituminous aggregate and other uses. A sizable tonnage of crushed limestone was sold for agricultural lime, roofing granules, and other purposes.

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[1] Industry economist, Division of Nonmetallic Minerals.

Table 1.—Value of mineral production in Rhode Island, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value.
Kent	W	W	Sand and gravel.
Newport	W	$45	Stone, sand and gravel.
Providence	$1,871	2,009	Sand and gravel, stone.
Washington	W	312	Sand and gravel.
Undistributed [2]	2,428	1,926	
Total	4,299	[3] 4,291	
Total 1967 constant dollars	3,655	p 3,570	

p Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Bristol County is not listed because no production was reported.

[2] Includes value of gem stones and sand and gravel that cannot be assigned to specific counties and values indicated by the symbol W.

[3] Data does not add to total shown because of independent rounding.

Table 2.—Indicators of Rhode Island business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force .... thousands..	401.1	415.7	+3.6
Unemployment .... do....	27.3	27.1	−.7
Employment:			
Manufacturing .... do....	114.1	116.7	+2.3
Durables .... do....	43.7	44.8	+2.5
Nondurables .... do....	70.5	71.9	+2.0
Nonmanufacturing .... do....	225.1	227.7	+1.2
Construction .... do....	14.4	15.6	+8.3
Service (including mining) .... do....	55.8	59.8	+7.2
Payroll-average weekly earnings:			
Manufacturing	$117.51	$124.43	+5.9
Personal income:			
Total .... millions..	$3,957	$4,258	+7.6
Per capita	$4,126	$4,399	+6.6
Construction activity: Cement shipments to Rhode Island thousand short tons..	3,538	3,428	−3.1
Mineral production value .... millions..	$4.3	$4.3	--

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; New England Economic Indicators; and U.S. Bureau of Mines.

Table 3.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries: Fatal	Number of injuries: Nonfatal	Injury rates per million man-hours: Frequency	Injury rates per million man-hours: Severity
1971:								
Sand and gravel	158	192	30	242	--	7	28.89	351
Stone	52	221	12	92	--	4	43.44	3,312
Total	210	199	42	334	--	11	32.90	1,166
1972:[1]								
Sand and gravel	100	224	22	180	--	5	27.78	294
Stone	40	234	10	79	--	1	12.72	102
Total	140	227	32	259	--	6	23.20	236

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tablulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Gem Stones.—Gem stones were collected by individuals and mineral clubs from mine and quarry dumps and from quarries and other exposed rock outcrops.

Sand and Gravel.—Sand and gravel was produced by 14 commercial producers and one Government-and-contractor operation. Leading producers were Rhode Island Sand & Gravel Co., Inc.; A. Cardi Construction Co., Inc.; and Forte Brothers, Inc. About 90% was mined in Kent and Providence Counties; the remainder was produced in Newport and Washington Counties. The use pattern was paving, 49%; building, 34%; and fill, molding sand, and miscellaneous use, 17%. Tonnage decreased 8%, but value increased 9%. Average value per ton increased from $1.36 in 1971 to $1.60 in 1972. Transportation was mainly by truck; a small tonnage was transported by railroad.

Stone.—Three stone quarries were active during 1973. The Conklin Limestone Co., Inc., produced crushed limestone at Ashton, Providence County. Principal uses were agricultural limestone, terrazzo chips, and roofing granules. A quantity of stone for metallurgical flux was produced for local customers. M. A. Gammino Construction Co. operated its granite quarry at Cranston, Providence County, throughout 1972 and produced crushed and broken granite for bituminous and concrete aggregate, roadstone, riprap, and stone sand. Peckham Brothers Co., Inc., quarried and crushed conglomerate at Middletown, Newport county, for use as macadam aggregate and roadstone. Providence Granite Co. reported its dimension granite quarry in Washington County was not operated in 1972. Value of stone production declined 23%, reflecting the drop in number of active quarries from four to three.

Table 4.—Rhode Island: Sand and gravel sold or used, by uses in 1972

(Thousand short tons and thousand dollars)

Use	Quantity	Value
Sand:		
Building	338	W
Fill	50	W
Paving	624	W
Other[1]	29	W
Total[2]	1,041	1,571
Gravel:		
Building	374	679
Paving	385	791
Miscellaneous[3]	278	295
Total[2]	1,038	1,766
Total sand and gravel[2]	2,079	3,336

W Withheld to avoid disclosing company confidential data; included with total sand.

[1] Includes molding sand.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes fill gravel.

MINERAL FUELS

Petroleum.—Mobil Oil Corporation operated a petroleum refinery in East Providence. The plant utilized unfinished oils from the gulf coast and foreign countries to produce asphalt and fuel oil.

Table 5.—Principal producers

Commodity and company	Address	Type of activity	County
Petroleum:			
Mobil Oil Corporation	1001 Wampanoag Trail E. Providence, R.I. 02915	Refinery	Providence.
Sand and gravel:			
A. Cardi Construction Co., Inc.	451 Arnold Road Coventry, R.I. 02816	Pit	Kent.
Del Bonis Sand & Gravel Co.	950 Phenix Ave. Cranston, R.I. 02920	Pit	Providence.
Forte Brothers, Inc	14 Whipple St. Berkeley, R.I. 02900	Pit	Do.
Rhode Island Sand & Gravel Co., Inc.	Kilvert St. Hillsgrove, R.I. 02886	Pit	Kent.
J. Romanella & Sons Inc	Box 546, Westerly, R.I. 02891.	Pit	Washington.
J. Santoro, Inc	11 Herbert Street Providence, R.I. 02909	Pit	Providence.
Silvestri Brothers	Johnston, R.I. 02919	Pit	Do.
South County Sand & Gravel Co., Inc.	North Rd. Peace Dale, R.I. 02883	Pit	Washington.
Tasca Sand & Gravel Co	Box 118, R.F.D. 4 Esmond, R.I. 02917	Pit	Providence.
Stone:			
Limestone, crushed:			
The Conklin Limestone Co., Inc.	R.F.D. 1 Lincoln, R.I. 02865	Quarry	Do.
Other stone, crushed and broken:			
M. A. Gammino Construction Co.	875 Phenix Ave. Cranston, R.I. 02920	do	Do.
Peckham Brothers Co., Inc.	Paradise Ave. Newport, R.I. 02840	do	Newport.

The Mineral Industry of South Carolina

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the South Carolina Division of Geology, State Development Board, for collecting information on all minerals except fuels.

By Robert G. Clarke[1]

The value of mineral production in South Carolina in 1972 increased 23% over that of 1971, reaching a record high of $82.3 million. Production of all mineral commodities increased in both quantity and value except that of feldspar, for which slight decreases were reported in both quantity and value.

The production of kaolin and vermiculite in South Carolina ranked second nationally in quantity and value, that of feldspar ranked fourth in quantity and fifth in value, that of mica ranked fifth in quantity and fourth in value, and that of peat ranked twelfth in quantity and value.

Legislation and Government Programs.—The South Carolina Pollution Control Authority on January 18, 1972, established air pollution regulations and standards which apply to the mining industry. Under these regulations, restrictions were established on the amounts of allowable discharge of particulate matter and of sulfur dioxide from fuel burning operations. Standards were set for airborne particulate matter originating from mining, quarrying, and other nonenclosed operations for both plant premises and beyond property lines. The authority also regulated the rate of emission of particulate matter from cement plants.

The State enacted a bill to join the Interstate Mining Compact, under which an effective program for the conservation and use of mined land will be established by the enactment of enabling laws.

Topaz from the Brewer mine near Jefferson, Chesterfield County, was tested at the Federal Bureau of Mines laboratory in Tuscaloosa, Ala. Bureau personnel have tested topaz samples from various sections of the country as a possible source of fluorine.

Table I.—Mineral production in South Carolina[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays .... thousand short tons..	[2] 2,049	[2] $10,201	2,221	$11,268
Sand and gravel .... do....	6,438	9,119	[3] 7,916	[3] 12,121
Stone .... do....	[r] 11,047	17,852	12,482	21,819
Value of items that cannot be disclosed:				
Cement, fire clay (1971), feldspar, mica (scrap), peat, and vermiculite	XX	29,716	XX	37,105
Total	XX	66,888	XX	82,318
Total 1967 constant dollars	XX	56,875	XX	[p] 68,476

[p] Preliminary. [r] Revised. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes value of fire clay; included with "Value of items that cannot be disclosed."

[3] Data not directly comparable with previous years because of increased industry coverage.

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[1] Physical scientist, Division of Nonmetallic Minerals.

Table 2.—Value of mineral production in South Carolina, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Aiken	$7,985	$8,080	Clays, sand and gravel.
Berkeley	W	W	Stone, clays.
Cherokee	1,557	W	Stone, clays, sand and gravel.
Chesterfield	717	897	Sand and gravel, clays.
Colleton	W	W	Peat.
Dorchester	W	W	Cement, stone, sand and gravel, clays.
Edgefield	W	24	Clays.
Fairfield	W	1,564	Stone, clays.
Florence	W	W	Sand and gravel.
Greenville	1,748	W	Stone, sand and gravel.
Greenwood	W	W	Stone, clays.
Horry	W	W	Sand and gravel, clays.
Jasper	W	W	Sand and gravel.
Kershaw	818	1,274	Sand and gravel, clays, stone.
Lancaster	W	W	Mica, clays, sand and gravel.
Laurens	W	W	Vermiculite, stone.
Lexington	4,920	7,000	Sand and gravel, stone, clays.
Marion	W	W	Sand and gravel, clays.
Marlboro	W	W	Do.
Newberry	W	W	Clays, stone.
Oconee	--	W	Stone.
Orangeburg	W	W	Cement, stone, clays, sand and gravel.
Pickens	W	W	Stone.
Richland	2,848	3,625	Stone, sand and gravel, clays.
Spartanburg	W	W	Stone, feldspar, sand and gravel.
Sumter	W	W	Sand and gravel, clays.
York	W	W	Stone.
Undistributed	46,848	59,847	
Total [2]	66,888	82,813	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Abbeville, Allendale, Anderson, Bamberg, Barnwell, Beaufort, Calhoun, Charleston, Chester, Clarendon, Darlington, Dillon, Georgetown, Hampton, Lee, McCormick, Saluda, Union, and Williamsburg.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of South Carolina business activity

		1971	1972 p	Change, percent
Employment and labor force, annual average:				
Total work force	thousands	1,120.9	1,170.8	+4.5
Unemployment	do	58.3	48.4	−17.0
All employment	do	1,062.6	1,122.4	+5.6
Wage and salary employment:				
Mining	do	1.6	1.7	+6.2
Contract construction	do	54.5	61.0	+11.9
Transportation, communication, and public utilities	do	38.4	40.7	+6.0
Manufacturing	do	337.3	353.6	+4.8
Trade	do	147.8	160.7	+8.7
Finance, insurance, real estate	do	31.2	33.8	+8.3
Services	do	95.2	102.3	+7.5
Government	do	156.7	165.2	+5.4
Personal income:				
Total	millions	$8,274.0	$9,188.0	+11.0
Per capita		$3,142.0	$3,448.0	+9.7
Construction activity:				
Value of nonresidential construction	millions	73.6	89.2	+21.2
Number of housing units authorized		26,822.0	29,954.0	+11.7
Farm marketing receipts	millions	$507.3	$608.8	+20.0
Mineral production value	do	$66.9	$82.3	+23.0

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Portland and masonry cements were produced by Giant Portland Cement Co. in Dorchester County and Santee Portland Cement Corp. in Orangeburg County. Shipments of portland cement increased 10% and shipments of masonry cement increased 30%. Ninety-nine percent of the portland cement shipped was types I and II for general use; the remainder was type III, high-early-strength. Portland cement consumed in South Carolina totaled 909,639 tons; masonry cement consumption was 164,532 tons. Most of the shipments

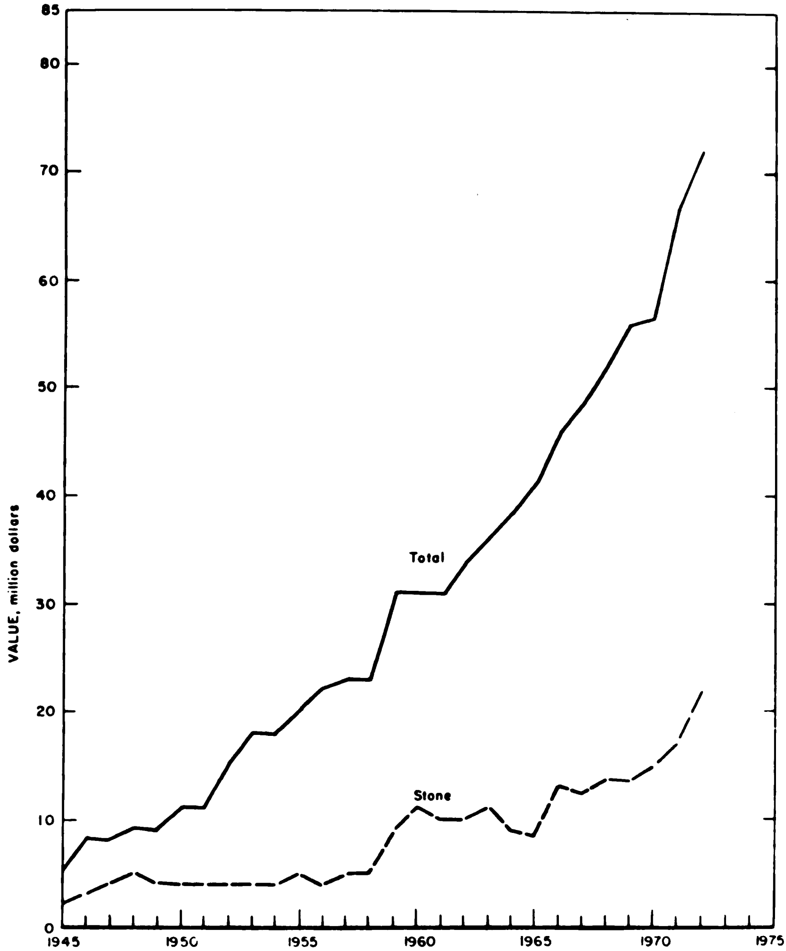

Figure 1.—Value of stone, and total value of mineral production in South Carolina.

were for ready-mix concrete products and building materials usage; a small percentage went into highway construction. Natural gas and fuel oil were used as fuels, depending on seasonal rates. The raw materials used consisted mostly of limestone or marl, clay, and additives such as gypsum, iron-bearing materials, air entraining compounds, and grinding aids. Expansion programs were begun but completion will be in 1973 and 1974. Giant Portland Cement Co. estimated the cost to be $10 million to add a fifth kiln. Santee Portland Cement Corp. estimated the cost to be $12 million to add a second kiln to its plant. Gifford-Hill & Co., Inc., of Dallas, Tex., commenced construction of a plant near Harleyville, Dorchester County, estimated to cost $25 million. On completion, the Gifford-Hill plant will be rated at 564,000 tons annual capacity. The Santee Portland Cement Corp. plant will be rated at 1,128,000 tons annual capacity. There will not be a direct increase in the capacity of the Giant Portland Cement Co. plant because the company plans to shutdown its oldest kiln. All three plant expansions included multimillion-dollar dust control systems.

Clays.—Total clay production accounted for 10% of the value of mineral production in South Carolina. The quantity produced increased 8% and the value increased 10%.

Production of kaolin increased 51% in quantity to 681,000 tons and the value increased 13% to $8,998,000. Output of kaolin in South Carolina was second highest in the Nation. The canvass forms for clays were revised for 1972 production reporting. As a result, an improved breakdown of kaolin sales by type and end usage was obtained, and these are shown in table 5. The principal domestic uses for airfloated kaolin were in rubber, fertilizers, pesticides and fungicides, and adhesives. The principal uses for unprocessed kaolin were in face brick and refractories. Kaolin was produced by 11 companies at 16 operations in five counties. The leading producing companies were J. M. Huber Corp., Dixie Clay Co., and Cyprus Mines Corp. Ranked by quantity of production, the counties in which kaolin was produced were Aiken, Lexington, Kershaw, Marlboro, and Richland.

Production of common clay and shale decreased 4% in quantity and increased 1% in value. Twenty-seven mines were operated by 19 companies in 18 counties. By quantity of production, the leading counties, ranked in descending order were as follows: Greenwood, Dorchester, Marlboro, Richland, Lancaster, and Newberry. The leading producers by quantity produced, were Southern Brick Co. in Greenwood and Newberry Counties, Richtex Corp. in Fairfield, Lexington, and Richland Counties, and Giant Portland Cement Co. in Dorchester County.

Table 4.—South Carolina: Kaolin sold or used by producers, by kind and use

(Thousand short tons)

Kind and use	1971	1972
Airfloated:		
Adhesives	NA	19
Fertilizers	W	42
Firebrick, block, and shapes	W	8
Paint	7	W
Pesticides and related products	8	28
Rubber	226	227
Exports	[1] 49	[2] 61
Other uses [3]	160	59
Total	450	439
Unprocessed: Face brick and firebrick and block	NA	242
Grand total	450	681

NA Not available. W Withheld to avoid disclosing individual company confidential data; included in "Other uses."

[1] End uses not available.

[2] Fertilizers and rubber.

[3] Includes animal feed, chemicals (1971), fine china/dinnerware (1972), drilling mud (1971), fiberglass floor and wall tile, gypsum products (1972), paper filling, pottery (1972), sanitary ware (1972), whiteware (1971), other uses, and uses indicated by symbol W.

Feldspar.—Production of feldspar decreased 12% in quantity and 11% in value. The State continued to rank fourth nationally in feldspar production. The one producer, Spartan Minerals Co., Spartanburg County, recovered feldspar as a byproduct feldspar—silica mixture from purchased crushed granite fines. The recovered mixture was used primarily in the manufacture of pottery, glass, and rubber.

Mica.—Mica was produced from sericite as flake and scrap at the operation of The Mineral Mining Corp. in Lancaster County. Production increased 27% in quantity and 19% in value. Output from South Carolina was fifth in rank nationally in quantity and fourth in value. After dry milling, the finished mica was sold for uses mainly in paint, joint cement, and electronics.

Sand and Gravel.—Sand and gravel was produced in 17 counties at 33 locations and ranked third in value of mineral commodities produced in South Carolina. Production of sand and gravel totaled 7.9 million short tons valued at $12.1 million. The average value per ton increased from $1.42 per ton in 1971 to $1.53 per ton in 1972. All sand and gravel was commercial production.

Data for 1972, which show considerable gains over those of 1971, are not directly comparable with those of previous years because revisions in the Bureau of Mines mailing lists resulted in increased industry coverage.

The leading counties ranked in descending order by quantity, were Lexington, Marlboro, Sumter, and Chesterfield; ranked in descending order by value, Marlboro, Lexington, Sumter, and Chesterfield Counties.

Stone.—The quantity of stone produced increased 13% and the value increased 22%. The value of stone production accounted for 26% of the total value of mineral production in the State.

Crushed granite was produced in 11 counties from 15 quarries by four companies: Caldwell Engineering Co., Lone Star Industries, Inc., Martin-Marietta Corp., and Vulcan Materials Co. Pickens, Lexington, Richland, Spartanburg, Greenville, and Greenwood Counties, in that order, led in the production of crushed granite in South Carolina. Crushed granite, in the order of use, was used for bituminous aggregate, macadam aggregate, road base stone, concrete aggregate, miscellaneous aggregate, road surface treatment, railroad ballast, riprap, and jetty stone. More than

Table 5.—South Carolina: Sand and gravel sold or used by producers by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Blast sand	W	W	37	140
Building sand	2,948	1,889	4,218	3,366
Fill sand	W	W	147	67
Paving sand	1,002	460	716	W
Other sand and gravel [1]	2,488	6,769	2,805	8,549
Total [2]	6,438	9,119	[3] 7,916	[3] 12,121

W Withheld to avoid disclosing individual company confidential data; included with "Other sand and gravel."

[1] Includes railroad ballast, glass (ground), molding, fire-furnace, engine (1972), filtration, abrasives, chemical, filler, foundry (1972), glass (unground), pottery, and other sands; building, paving (1971), fill, and other gravel.

[2] Data may not add to totals shown because of independent rounding.

[3] Data not directly comparable with previous years because of increased industry coverage.

85% of the crushed granite was transported by truck; and, the remainder, by rail.

Dimension granite was produced from six quarries mostly for monumental use. Winnsboro Granite Co. operated a quarry in Fairfield County and Comolli Granite Co. operated two quarries in Kershaw County. Kershaw Granite Co., Inc. operated two quarries in Kershaw County and a quarry in Newberry County.

Crushed limestone was produced by Vulcan Materials Co. from a quarry in Cherokee County, and by Martin-Marietta Corp. from a quarry in Berkeley County. The principal uses for crushed limestone, by order of use, were for road base stone, agricultural limestone, road surface treatment, macadam aggregate, bituminous aggregate, concrete aggregate, riprap, and jetty stone. Crushed marl was produced by Giant Portland Cement Co. from a quarry in Dorchester County and by Santee Portland Cement Corp. from a quarry in Orangeburg County. Crushed marl was used by both producing companies in the manufacture of cement.

Vermiculite.—Production of crude vermiculite increased 6% in quantity in 1972 over that of 1971, and value increased 8%. Concrete Products Div., W. R. Grace & Co., produced crude vermiculite from its mines in Laurens County and exfoliated vermiculite in Greenville and Laurens Counties. Patterson Vermiculite Co. produced crude and exfoliated vermiculite in Laurens County. Exfoliated vermiculite was used as follows: 57% for soil additives, 26% for lightweight aggregates (concrete, plaster, and roofing), and 17% for loose insulation and block insulation.

The production of crude vermiculite in South Carolina was less than that in Montana, the only other State in which vermiculite was produced in 1972.

Table 6.—South Carolina: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Aiken	1	114	W	1	W	184
Chesterfield	3	1,041	717	4	703	W
Jasper	1	195	191	1	W	W
Kershaw	2	181	450	2	W	W
Lancaster	1	W	W	1	27	32
Lexington	4	979	1,952	9	2,127	3,300
Richland	1	W	W	1	287	367
Undistributed [1]	[r] 18	3,928	5,809	14	4,771	8,239
Total [2]	26	6,438	9,119	33	[3] 7,916	[3] 12,121

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Cherokee, Dorchester, Florence, Greenville, Horry, Marion, Marlboro, Orangeburg (1972), Pickens (1971), Spartanburg, and Sumter Counties.

[2] Data may not add to totals shown because of independent rounding.

[3] Data not directly comparable with previous years because of increased industry coverage.

METALS

Ferroalloys.—Airco Alloys Division of Airco, Inc., produced special alloys in Charleston, Charleston County.

Iron and Steel.—The second metallized iron pellet plant in the United States was started by Midland-Ross Corp. in 1971 at Georgetown, Georgetown County. The plant, rated at 400,000 tons per year, was to serve primarily as a source of melting stock for the adjoining electric furnace steelmaking plant of Georgetown Steel Co., a subsidiary of Korf Industries of Germany.[2] The pellets were also shipped from Georgetown by barge to the electric furnace plant of the Lukens Steel Co. in Wilmington, Del. The Georgetown Steel Co. supplemented the use of pellets by using scrap to produce rods and wire.

Zirconium.—M & T Chemicals, Inc., operated a grinding plant near Andrews, Georgetown County, for the production of milled zircon for foundry, refractory, ceramic, and glass uses. The zircon mineral was obtained from out-of-State sources.

MINERAL FUELS

Peat.—Production of peat increased again to put South Carolina into 12th place in the production of peat in the United States. United States Peat Corp. operated from a bog near Green Pond, Colleton County. About 55% of the peat was sold in packaged form and the remainder was sold in bulk. All of the peat was used for general soil improvement.

Table 7.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Giant Portland Cement Co	150 Strafford Ave. Wayne, Pa. 19087	Plant	Dorchester.
Santee Portland Cement Corp.	Box 698 Holly Hill, S.C. 29059	do	Orangeburg.
Clays:			
Kaolin:			
Cyprus Mines Corp	Box 1201 Trenton, N.J. 08606	Mine	Aiken.
Dixie Clay Co	230 Park Ave. New York, N.Y. 10017	2 mines	Do.
J. M. Huber Corp	630 Third Ave. New York, N.Y. 10017	4 mines	Do.
National Kaolin Products Co	Box 431 Aiken, S.C. 29801	Mine	Do.
Southeastern Clay Co.	Box 1055 Aiken, S.C. 29801	6 mines	Do.
Common clay and shale:			
Ashe Brick Co	Van Wyck, S.C. 29744	Mine	Lancaster.
Broad River Brick Co.	Box 550 Gaffney, S.C. 29340	do	Cherokee.
Giant Portland Cement Co.	150 Strafford Ave. Wayne, Pa. 19087	do	Dorchester.
Guignard Brick Co	Box 568 Cayce, S.C. 29033	3 mines	Lexington.
Palmetto Brick Co	Box 430 Cheraw, S.C. 29520	Mine	Marlboro.
Richtex Corp	Box 3307 Columbia, S.C. 29203	6 mines	Fairfield, Lexington, Richland.
Santee Portland Cement Co.	Box 698 Holly Hill, S.C. 29059	Mine	Orangeburg.
Southern Brick Co	Box 208 Ninety Six, S.C. 29666	2 mines	Greenwood and Newberry.
Feldspar, crude:			
Spartan Minerals Co	Route 1, Box 14A Pacolet, S.C. 29372	Plant	Spartanburg.
Mica, flake and scrap:			
The Mineral Mining Corp.	Kershaw, S.C. 29067	Mine	Lancaster.
Peat:			
United States Peat Corp	Box 568 Walterboro, S.C. 29488	Bog	Colleton.
Sand and gravel:			
Becker Sand & Gravel Co	Box 848 Cheraw, S.C. 29520	5 mines	Chesterfield, Dorchester, Marlboro, Sumter.
Columbia Silica Sand Co	Box 1519 Columbia, S.C. 29202	2 mines	Lexington.
Foster Dixiana Sand Inc	P.O. Box 5447 Columbia, S.C. 29250	Mine	Do.
Palmetto Quarries Co	Drawer 5185 Columbia, S.C. 29205	do	Richland.
Pennsylvania Glass Sand Corp.	Gen. Operations Dept. Berkeley Springs, W. Va. 25411	do	Lexington.

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[2] Jensen, H. B. Current Status of the Use and Production of Prereduced Iron. Iron and Steel Eng. v. 49, No. 11. November 1972, pp. 59–66.

Table 7.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone:			
Granite, crushed:			
Martin-Marietta Corp.	Box 2568 Raleigh, N.C. 27602	4 quarries	Fairfield, Lexington, Richland, York.
Lone Star Industries, Inc.	Drawer 5185 Columbia, S.C. 29205	3 quarries	Fairfield, Greenwood, Richland.
Vulcan Materials Co.	Drawer 8834 Greenville, S.C. 29604	4 quarries	Greenville, Laurens, Pickens, Spartanburg.
Granite, dimension:			
Caldwell Engineering Co.	P.O. Box 159 Walhalla, S.C. 29691	2 quarries	Anderson and Oconee.
Comolli Granite Co.	Box 898 Elberton, Ga. 30635	do	Kershaw.
Kershaw Granite Co., Inc.	Box 250 Elberton, Ga. 30635	3 quarries	Kershaw and Newberry.
Winnsboro Granite Co	Rion, S.C. 29132	Quarry	Fairfield.
Limestone, crushed:			
Martin-Marietta Corp.	Box 2568 Raleigh, N.C. 27602	do	Berkeley.
Vulcan Materials Co.	Drawer 8834 Greenville, S.C. 29604	do	Cherokee.
Marl, crushed:			
Giant Portland Cement Co.	150 Strafford Ave. Wayne, Pa. 19087	do	Dorchester.
Santee Portland Cement Co.	Box 698 Holly Hill, S.C. 29059	do	Orangeburg.
Vermiculite:			
Crude:			
W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	Several mines	Laurens.
Patterson Vermiculite Co.	Route 1 Enoree, S.C. 29335	Mine	Do.
Exfoliated:			
W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	2 plants	Greenville and Laurens.
Patterson Vermiculite Co.	Route 1 Enoree, S.C. 29335	Plant	Laurens.

The Mineral Industry of South Dakota

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the South Dakota State Geological Survey for collecting information on all minerals except fuels.

By J. M. West[1]

The value of mineral production in South Dakota rose to an alltime high of $65.2 million in 1972, 3.5% more than in 1971. Metals, principally gold, accounted for more than one-third of the value and nonmetals for most of the balance. Petroleum accounted for less than 1% of the total. The value for metals was $25.2 million, up 8.7% compared with that in 1971, largely because of an increase in the average price of gold to $58.60 per ounce. The value for nonmetals was $39.4 million, up only slightly from that in 1971. Fuels, consisting solely of petroleum, were valued at $0.57 million, 5% lower than in 1971.

Gold accounted for 95% of South Dakota's total metal output value. The State fell to second in the Nation behind Nevada in gold production, with the famous Homestake mine at Lead, S. Dak., reporting a sharp drop in production to 407,430 troy ounces of gold valued at nearly $24 million. Although the value of gold rose 13% in 1972 owing to price increases, the quantity of gold produced in the State fell 21% owing principally to a strike at the Homestake mine.

One of the most disastrous floods in South Dakota's history struck the State on June 9, 1972, causing severe damage to some mining communities such as Keystone and interrupting rail service throughout the area. The greatest damage was done in Rapid City when a dam on Rapid Creek collapsed. Progress on a pollution control project for Whitewood Creek was delayed by legal proceedings of landowners in Centennial Valley where the Lead-Deadwood Sanitary District planned to secure 600 acres as a site for a tailings

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[1] Physical scientist, Division of Nonferrous Metals.

Table 1.—Mineral production in South Dakota [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays [2] ..... thousand short tons	150	$128	185	$156
Feldspar ..... short tons	r 24,640	539	11,227	150
Gem stones	NA	40	NA	42
Gold (recoverable content of ores, etc.) ..... troy ounces	513,427	21,179	407,430	23,875
Gypsum ..... thousand short tons	21	83	24	43
Petroleum (crude) ..... thousand 42-gallon barrels	238	604	219	574
Sand and gravel ..... thousand short tons	16,727	18,392	12,748	14,793
Silver (recoverable content of ores, etc.) ..... thousand troy ounces	107	165	100	168
Stone ..... thousand short tons	2,199	8,874	2,665	10,864
Value of items that cannot be disclosed:				
Beryllium concentrate, cement, clay (bentonite), lime, mica (scrap), uranium, vanadium (1972)	XX	12,984	XX	14,535
Total	XX	62,988	XX	65,200
Total 1967 constant dollar	XX	53,558	XX	p 54,247

p Preliminary. r Revised NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes bentonite; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in South Dakota, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Aurora	W	$39	Sand and gravel.
Beadle	W	106	Do.
Bon Homme	$42	29	Do.
Brookings	779	W	Sand and gravel, stone.
Brown	181	W	Sand and gravel.
Brule	W	W	Do.
Buffalo	W	W	Do.
Butte	W	W	Clays, sand and gravel.
Campbell	308	W	Sand and gravel.
Charles Mix	140	9	Do.
Clark	155	W	Do.
Clay	W	14	Do.
Codington	840	W	Do.
Corson	W	W	Do.
Custer	685	255	Sand and gravel, feldspar, lime, petroleum, stone.
Davison	W	W	Sand and gravel.
Day	W	W	Do.
Deuel	W	18	Do.
Dewey	W	W	Do.
Douglas	W	115	Do.
Edmunds	318	--	
Fall River	W	W	Uranium, sand and gravel, vanadium, stone.
Faulk	140	23	Sand and gravel.
Grant	W	W	Stone, sand and gravel.
Gregory	154	W	Sand and gravel.
Haakon	--	W	Do.
Hamlin	260	70	Do.
Hand	524	74	Do.
Hanson	W	W	Stone, sand and gravel.
Harding	605	W	Petroleum, sand and gravel.
Hughes	W	W	Sand and gravel.
Hutchinson	W	W	Do.
Hyde	(2)	W	Do.
Jerauld	48	38	Do.
Kingsbury	22	16	Do.
Lake	W	W	Do.
Lawrence	21,558	24,566	Gold, sand and gravel, silver, stone.
Lincoln	W	55	Sand and gravel.
Lyman	W	78	Do.
McCook	W	W	Do.
McPherson	W	W	Do.
Marshall	438	W	Do.
Meade	368	W	Sand and gravel, gypsum.
Mellette	W	--	
Miner	7	--	
Minnehaha	W	W	Stone, sand and gravel.
Moody	157	W	Sand and gravel.
Pennington	12,818	$14,762	Cement, stone, sand and gravel, lime, clays, feldspar, mica, beryllium.
Perkins	294	87	Sand and gravel.
Potter	W	36	Do.
Roberts	257	W	Do.
Sanborn	4	41	Do.
Shannon	35	W	Do.
Spink	W	27	Do.
Stanley	W	--	
Sully	W	W	Sand and gravel.
Todd	69	--	
Tripp	188	39	Stone.
Turner	W	W	Sand and gravel.
Union	184	21	Do.
Walworth	W	--	
Washabaugh	W	W	Sand and gravel.
Yankton	W	179	Do.
Ziebach	55	W	Do.
Undistributed[3]	21,982	24,492	
Total[4]	62,988	65,200	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Bennett, Jackson, and Jones Counties are not listed because no production was reported.

[2] Less than ½ unit.

[3] Includes gem stones, some sand and gravel that cannot be assigned to specific counties, and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

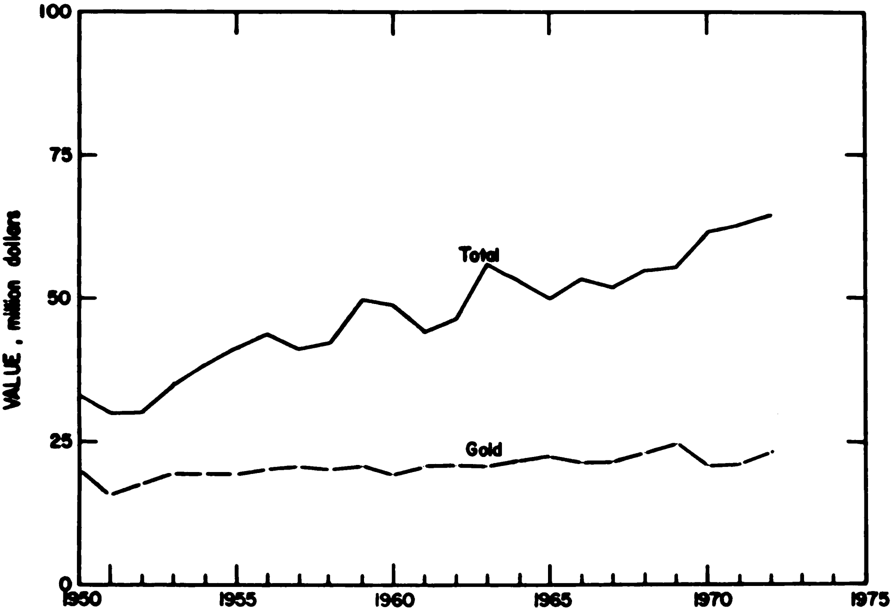

Figure 1.—Value of mine production of gold, and total value of mineral production in South Dakota

Table 3.—Indicators of South Dakota business activity

(Thousands)

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force......thousands..	278.8	286.8	+2.9
Employment......do....	268.9	276.4	+2.8
Unemployment......do....	9.9	10.4	+5.0
Nonagricultural employment......do....	182.3	189.4	+3.9
Mining......do....	2.3	2.1	−8.7
Construction......do....	7.8	8.4	+7.7
Manufacturing......do....	16.5	18.0	+9.1
Government......do....	56.4	57.6	+2.1
Other nonagricultural employment......do....	99.3	103.3	+4.0
Personal income:			
Total......millions..	$2,321	$2,523	+8.7
Per capita......	$3,441	$3,716	+8.0
Construction activity:			
Highway construction contracts awarded......thousands..	$50,471	e $47,500	−5.9
Cement shipments to and within South Dakota..thousand short tons..	329	326	−0.9
Number of authorized residential units......	2,729	3,297	+20.8
Value of nonresidential construction......millions..	$12.7	$36.0	+183.5
Mineral production value......thousands..	$62,988	$65,200	+3.5

e Estimate. p Preliminary.

Source: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

pond. The pond was part of a $6 million sewage and tailings disposal project that would handle Homestake milling wastes as well as town sewage. Exploration and permeability testing were conducted at the site of the pond in late 1972.

The experimental coal gasification pilot plant at Rapid City, for testing Consolidation Coal Co.'s CO_2 acceptor process of manufacturing gas from lignite, was dedicated in mid-August, and preliminary tests were run. A breakdown of furnace linings and other problems delayed production runs on the process until early 1973.

Work was conducted at the South Dakota School of Mines and Technology, under a Federal Bureau of Mines grant, on establishing fish tolerance to organic flotation reagents used in milling metal ores. The project was continued in 1973.

Among U.S. Geological Survey publications dealing with South Dakota in 1972 were several maps showing general geological features in the Nemo district of the Black Hills and in an area near Rapid City.[2]

Employment and Injuries.—Employment and injuries in the mineral industry, exclusive of the petroleum industry, is shown in table 4.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	1,680	310	520	4,167	1	91	22.08	2,712
Nonmetal	156	170	26	215	1	11	55.71	28,362
Sand and gravel	822	166	137	1,340	1	34	26.12	5,058
Stone	540	260	140	1,160	--	32	27.58	804
Total[1]	3,198	258	824	6,883	3	168	24.85	3,650
1972:[2]								
Metal	1,540	267	411	3,290	6	92	29.79	13,563
Nonmetal	85	194	16	138	--	14	101.17	2,710
Sand and gravel	315	141	44	413	--	7	16.93	428
Stone	380	300	114	964	--	17	17.64	195
Total[1]	2,320	253	586	4,806	6	130	28.30	9,440

[1] Data may not add to totals shown because of independent rounding.
[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Production and shipments of cement exceeded those of 1971 by about 16%. Record sales of 502,000 short tons of portland cement compared with 414,000 short tons in 1971 were reported. Net profits were reported at a record high of $5.0 million compared with $3.6 million in 1971. All production was from the State-owned plant operated by the South Dakota Cement Commission at Rapid City, Pennington County. The commission also maintained distribution terminals in Chamberlain and Aberdeen, S. Dak., and Bismarck, N. Dak., as well as in Rapid City. Construction of a four-silo, 3,800-ton-capacity distribution terminal at Sioux Falls was underway in 1972. Most cement was used in the building industry, and the remainder, in highway construction. Nearly 80% of the total shipments were within the State, and most of the balance went to North Dakota and Wyoming. Raw materials consumed in cement production were as follows, in thousand tons: Limestone, 389; shale, 134; sand, 24; gypsum, 24; and iron ore, 7.

Clays.—Production of clays rose sharply in 1972. Bentonite for use in oil well drilling and for growing usage in foundry clay and taconite processing, accounted for about half of the quantity and the bulk of the value. The balance consisted of other types of clays used for cement, lightweight aggregate, and bricks. The American Colloid Co. continued to operate the State's only bentonite-processing plant using crude materials from South Dakota and Wyoming. Black Hills Clay Products, Inc., with operations at Belle Fourche, was sold in December to a group of South Dakota investors. The firm was the State's only brick manufacturer; its products were sold in eight other States.

Feldspar.—Feldspar production was about half the quantity produced in 1971, and value was sharply lower in 1972. The

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[2] Bayley, R. W. Preliminary Geologic Map of the Nemo District, Black Hills, S. Dak. U.S. Geol. Survey Map I-712, 1972.
Cattermole, J. M. Geologic Map of the Rapid City East Quadrangle, Pennington County, S. Dak. U.S. Geol. Survey Map GQ-986, 1972.

June 9, 1972, flood was a factor in the drop because of its destruction of railroad siding and loading facilities at the Keystone operations of the Northwest Feldspar Co. Nearly all of the 11,200 tons produced came from Custer County. The bulk was sold to and processed by the International Minerals and Chemical Corp., which operated a grinding plant at Custer. Products were shipped nationwide. Late in the year, the Pacer Corp. purchased the Custer mill and Black Hills properties of International Minerals and Chemical Corp. Two mines were active in Custer County, and two mines were active in Pennington County.

Gypsum.—The South Dakota Cement Commission operated a small surface mine in Meade County to supply its needs for gypsum as a cement ingredient. Production totaled about 24,000 tons valued at $43,000.

Lime.—The production of lime, by two operators, Pete Lien & Sons, Rapid City, and the Black Hills Lime Co., Pringle, increased 2% in 1972 to a record level. The bulk of the output was hydrated lime, but some was quicklime. Consumption in South Dakota was 26,280 tons. Lime was also shipped to Colorado, North Dakota, and other States.

Mica.—A small tonnage of scrap and

Table 5.—South Dakota: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Aurora	1	W	W	1	60	89
Beadle	2	W	W	3	W	106
Bon Homme	1	149	42	1	W	29
Brookings	5	552	773	8	521	571
Brown	3	163	181	3	189	W
Campbell	4	263	249	3	W	W
Charles Mix	2	121	140	3	W	9
Clark	1	108	155	1	W	W
Clay	3	W	W	2	W	14
Codington	8	753	840	7	485	W
Deuel	1	W	W	1	27	18
Douglas	6	120	W	3	100	115
Edmunds	1	W	318	--	--	--
Fall River	2	186	W	4	254	220
Faulk	--	97	140	1	28	28
Gregory	3	192	154	2	W	W
Hamlin	4	270	260	3	91	70
Hand	6	524	524	5	186	74
Harding	1	60	26	2	W	W
Hyde	1	41	(1)	1	W	W
Jerauld	1	40	48	1	52	88
Kingsbury	5	180	22	3	W	16
Lawrence	4	W	W	6	486	496
Lincoln	3	W	W	3	75	55
Lyman	2	W	W	2	105	78
Marshall	3	367	433	5	W	W
Meade	1	186	280	2	W	W
Miner	1	67	7	--	--	--
Minnehaha	15	1,741	1,734	14	912	912
Moody	4	238	157	4	153	W
Pennington	10	1,124	1,393	8	823	1,114
Perkins	4	231	294	5	104	87
Potter	2	W	W	1	W	86
Roberts	3	249	257	2	W	W
Sanborn	1	37	4	1	W	41
Shannon	2	47	35	1	W	W
Spink	1	W	W	1	73	27
Todd	1	61	69	--	--	--
Tripp	1	54	86	--	--	--
Union	1	102	134	1	30	21
Yankton	4	W	W	3	162	179
Ziebach	--	31	55	1	W	W
Undistributed [2]	[r] 61	8,423	9,585	49	7,938	10,411
Total [3]	185	16,727	18,392	167	12,748	14,793

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[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Less than ½ unit.

[2] Includes Brule, Buffalo, Butte, Corson, Custer, Davison, Day, Dewey, Grant, Haakon (1972), Hanson; Hughes, Hutchinson, Lake, McCook, McPherson, Mellette (1971), Stanley (1971), Sully, Turner, Walworth (1971), and Washabaugh Counties, and some sand and gravel that cannot be assigned to specific counties.

[3] Data may not add to totals shown because of independent rounding.

Table 6.—South Dakota: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	798	983	604	765
Fill	140	65	96	45
Paving	564	807	382	399
Other uses [1]	9	2	21	28
Total [2]	1,506	1,856	1,104	1,238
Gravel:				
Building	829	461	340	506
Fill	459	252	195	112
Paving	5,081	5,102	3,760	3,994
Miscellaneous	W	W	334	399
Other uses [1]	798	546	39	175
Total [2]	6,611	6,862	4,668	5,186
Government-and-contractor operations:				
Sand:				
Fill	1	([3])	--	--
Paving	178	185	104	124
Other uses	--	--	85	25
Total [2]	179	185	189	148
Gravel:				
Building	26	24	26	18
Fill	62	8	18	5
Paving	8,220	9,834	6,675	8,080
Other uses	122	122	118	118
Total [2]	8,430	9,989	6,837	8,221
Total sand and gravel [2]	16,727	18,892	12,748	14,793

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes railroad ballast and other uses.

[2] Data may not add to totals shown because of independent rounding.

[3] Less than ½ unit.

flake mica was produced by one mine in Pennington County.

Sand and Gravel.—Sand and gravel was produced in all but 10 counties. Of the total output of 12.7 million tons, 7.0 million (55%) was produced for government agencies. A total of 167 mines operated in 1972 compared with 185 in 1971. Production included 1.2 million tons of sand and 11.5 million tons of gravel. Counties leading in output were Minnehaha, Pennington, and Brookings which collectively supplied 2.3 million tons, 18% of the total. A silica sand plant located at Pringle was dismantled during the year.

Stone.—Production of stone was higher in both tonnage and value in 1972. Granite, quartzite, limestone, quartz, and miscellaneous stone were mined or quarried. Granite, mostly prepared for monumental or architectural stone, was valued at $7.0 million, which was 65% of the total value of stone produced. The granite all came from Grant County, near Milbank, in the northeast corner of the State, and was supplied by five companies. Late in the year, the Milbank granite quarry of the Delano Granite Works, Inc. was sold to Minneapolis-based Rembrandt Enterprises, Inc. The State's limestone and quartzite production was valued at a total of $3.3 million.

METALS

Gold and Silver.—The Homestake gold mine at Lead processed 1.47 million tons of ore from which about 407,400 ounces of gold and 100,000 ounces of silver were recovered. The Homestake mine accounted for all of the State's production of gold and silver. Output was lower than that in 1971 because of a 6-week strike and continuing shortage of skilled miners. Sinking and equipping of the No. 6 winze (Ross extension) were almost completed from the collar on the 4550 level to the bottom of the shaft and mine at the 7216 level. Excavation of new deep level ventilation raises and drifts was 80% complete by

Table 7.—South Dakota: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone total [1]	36	5,654	37	7,017
Crushed and broken:				
Limestone	1,426	1,621	1,685	1,945
Quartz	W	65	W	W
Quartzite	701	1,476	W	W
Traprock	3	6	--	--
Other stone	34	54	944	1,905
Total [2]	2,199	8,874	2,665	10,864

W Withheld to avoid disclosing individual company confidential data; included with "Other stone."

[1] Data include granite, quartz (1972).

[2] Data may not add to totals shown because of independent rounding.

Table 8.—South Dakota: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars, unless otherwise specified)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough construction and architectural work	W	W	W	W
Dressed architectural thousand cubic feet	255	W	[1] 239	W
Rough monumental do	--	--	--	--
Dressed monumental do	112	2,874	178	4,290
Total (thousand short tons)	36	5,654	37	7,017
Crushed and broken stone:				
Bituminous aggregate	203	310	339	584
Concrete aggregate	506	856	781	1,360
Dense graded road base stone	(2)	(2)	(3)	(3)
Macadam aggregate	1	3	1	1
Surface treatment aggregate	60	124	51	75
Unspecified construction aggregate and roadstone	634	1,091	(3)	(3)
Cement manufacture	419	278	600	391
Railroad ballast	173	(3)	(3)	(3)
Riprap and jetty stone	42	70	58	108
Other uses [4]	125	494	799	1,329
Total [5]	2,164	3,220	2,628	3,847
Grand total [5]	2,199	8,874	2,665	10,864

W Withheld to avoid disclosing individual company confidential data; included in "Total."

[1] Data includes a minor amount of stone used in structural and sanitary purposes.

[2] Data combined with "Unspecified construction aggregate and roadstone," to avoid disclosing individual company confidential data.

[3] Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[4] Includes stone used for agricultural lime, lime manufacture, other fillers and uses not specified. 1972 data also include stone used for terrazzo.

[5] Data may not add to totals shown because of independent rounding.

yearend. New friction-drive hoisting equipment was installed. Measured ore reserves at yearend in the Homestake mine were estimated at 7.3 million tons averaging 0.299 ounce of gold per ton. Reserves were nearly 1.2 million tons more than that of a year earlier owing mainly to use of a lower cutoff grade in estimating. Indicated and inferred reserves totaled an additional 6.3 million tons. Metallurgical recovery was about 93.1% compared with 93.0% in 1971. Construction of a new char-in-pulp gold recovery system utilizing activated charcoal in the leaching circuits was virtually complete with startup scheduled for early 1973. At least a 2% overall improvement in metallurgical recovery was expected from the unit.

Three miles below Deadwood on Whitewood Creek, the New Era Mining Co. remodeled equipment (two large concentrating tables and thirty-six 8-foot Humphrey spiral classifiers) mounted on a steel boat and prepared to begin recovery of placer gold and mercury from old mill wastes. The company owned about 55 acres extending for 1 mile along the creek.

Table 9.—South Dakota: Mine production (recoverable) of gold and silver

	1970	1971	1972
Mines producing: Lode	2	1	1
Material sold or treated: Gold ore ... thousand short tons	1,954	1,800	1,467
Production (recoverable):			
Quantity:			
Gold ... troy ounces	578,716	513,427	407,430
Silver ... do	119,766	106,785	99,992
Value:			
Gold ... thousands	$21,059	$21,179	$23,875
Silver ... do	212	165	168
Total ... do	21,271	21,344	24,043

Table 10.—South Dakota: Homestake mine ore milled and receipts for bullion

Year	Ore milled (thousand short tons)	Receipts for bullion products	
		Total (thousands)	Per ton
1968	1,922	$22,064	$11.48
1969	1,935	24,570	12.70
1970	1,954	21,059	10.78
1971	1,800	21,179	11.77
1972	1,467	23,875	16.27

Source: Homestake Mining Co. Annual Reports.

Uranium.—Uranium production dropped 42% in quantity, and sales were valued 41% below the figure for 1971. Mines Development, Inc., owned by Susquehanna Corp., operated a mill at Edgemont, southwest of Custer. All production came from three open pit mines of Susquehanna Corp. in Fall River County. Ores contained about 2 pounds of U_3O_8 per ton of ore and included recoverable vanadium values. Reserves were reported to have been expanded significantly during the year as a result of further development work.

MINERAL FUELS

Coal (Lignite).—A proposal was prepared by the State Geologist to investigate coal resources in the Isabel area, Dewey County. Consolidation Coal Co., subsidiary of Continental Oil Corp., completed construction of a pilot plant for lignite gasification at Rapid City. The plant was dedicated in August and had several startup problems that delayed gasification tests until February 1973. Input capacity of the pilot plant, which used the CO_2 acceptor process, was about 40 tons of low-grade coal per day. The plant was built with funds provided by the U.S. Department of the Interior's Office of Coal Research and the American Gas Association.

Petroleum.—Output of petroleum declined 6% in quantity and nearly 5% in value. At yearend the State had 31 producing oil wells. Through November, production from about 25 wells in the Buffalo field, northwest of Buffalo, Harding County, was 130,633 barrels compared with 142,618 barrels for all of 1971 and included about 8 million cubic feet of natural gas used for repressuring. A single well of Depco, Inc., in the Yellow Hair field produced 63,924 barrels through November 1972. Four wells in the Barker Dome field, in Custer County, north of Edgemont, produced about 6,200 barrels of oil in 1972. Phillips Petroleum Co. brought an 8,778-foot well into production in August at about 40 barrels per day in the South Cave Hills area of Harding County.

Exploration drilling increased nearly 30% in footage, although the number of holes drilled was about the same as in 1971. Only four of 36 holes were successful in striking oil, and these were in proven fields. Depths ranged from about 950 to 9,340 feet and averaged about 3,700 feet. Quadrant Oil Co. reported a discovery of oil at a depth of about 9,340 feet in northern Harding County, about 25 miles north of Buffalo, and was casing the hole in December.

In November, the State reported the lease of over 10,000 acres of State and school lands for oil exploration in five western counties. The highest bid was $6.55 per acre for a tract in Dewey County.

Table 11.—South Dakota: Oil and gas well drilling completions, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Custer	--	--	--	--	--	1	1	4,125
Dewey	3	--	6	--	--	6	15	77,296
Fall River	--	--	--	--	--	4	4	7,468
Harding	1	--	--	--	--	10	11	57,417
Pennington	--	--	--	--	--	1	1	2,300
Perkins	--	--	--	--	--	2	2	9,970
Shannon	--	--	--	--	--	1	1	1,755
Tripp	--	--	--	--	--	1	1	1,568
Total	4	--	6	--	--	26	36	161,899

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 12.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
South Dakota Cement Commission.	Drawer 351 Rapid City, S. Dak. 57701	Wet-process, 3-rotary-kiln plant.	Pennington.
Clays:			
American Colloid Co	5100 Suffield Ct. Skokie, Ill. 60076	Open pit mine and plant.	Butte.
Light Aggregates, Inc	Box 1922 Rapid City, S. Dak. 57701	do	Pennington.
South Dakota Cement Commission.	Drawer 351 Rapid City, S. Dak. 57701	Open pit mine	Do.
Feldspar:			
George Bland	Custer, S. Dak. 57730	2 open pit mines	Custer.
Pacer Corp	Box 311 Custer, S. Dak. 57730	Open pit mines and dry-grinding plant.	Do.
Gold:			
Homestake Mining Co	Lead, S. Dak. 57754	Underground mine, cyanidation mill, and refinery.	Lawrence.
Gypsum:			
South Dakota Cement Commission.	Drawer 351 Rapid City, S. Dak. 57701	Open pit mine	Meade.
Lime:			
Pete Lien & Sons	Box 3124, P.O. Annex Rapid City, S. Dak. 57703	1-rotary-kiln, 1-vertical-kiln, continuous-hydrator plant.	Pennington.
Mica (scrap):			
L. W. Judson	Hermosa, S. Dak. 57744	Open pit mine	Do.
Petroleum:			
The Ozark Corp	Box 2491 Casper, Wyo. 82601	Crude oil wells	Custer (Barker Dome field).
Pennzoil United, Inc	900 Southwest Tower Houston, Tex. 77002	do	Harding (Buffalo field).
Phillips Petroleum Co	Frank Phillips Bldg. Bartlesville, Okla. 74003	do	Do.
Sand and gravel (commercial):			
Aggregates, Inc	Selby, S. Dak. 57472	Pit and plant	Lawrence.
Highway Construction Co	Box 511 Rapid City, S. Dak. 57701	2 plants	Pennington.
J. L. Healy Construction Co	Box 512 Sioux Falls, S. Dak. 57102	4 plants	Lyman, Minnehaha.
Mannerud Inc	612 13th Avenue Brookings, S. Dak. 57006	1 plant	Brookings.
Moeckly & Olson	Britton S. Dak. 57430	Pit	Marshall.
Northwestern Engineer Co	P.O. Box 16249 Stockyard Stratton Denver, Colo. 80216	1 pit	Fall River.
Tennefos Construction Co., Inc	2504 Fifth Avenue S Fargo, N. Dak. 58101	2 plants	Various.
Silver:			
Homestake Mining Co	Lead, S. Dak. 57754	*See* Gold	Lawrence.
Stone:			
Cold Spring Granite Co	Cold Spring, Minn. 56320	2 quarries	Grant.
Concrete Materials Co	3000 West Madison Street Sioux Falls, S. Dak. 57104	Quarry and plant	Minnehaha.
Dakota Granite Co	Box 269 Milbank, S. Dak. 57252	2 quarries	Grant.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Delano Granite Works, Inc	Delano, Minn. 55328	Quarry	Grant.
Hills Materials Co	Box 1392 Rapid City, S. Dak. 57701	Quarry and plant	Pennington.
L. G. Everist, Inc	302 Paulton Bldg. Sioux Falls, S. Dak. 57102	do do	Minnehaha. Pennington.
Pete Lien & Sons	Box 3124, P.O. Annex Rapid City, S. Dak. 57708	do	Do.
Robert Hunter Granite Co., Inc	Milbank, S. Dak. 57252	Quarry	Grant.
South Dakota Cement Commission.	Drawer 351 Rapid City, S. Dak. 57701	Quarry and plant	Pennington.
Spencer Quarries, Inc	Spencer, S. Dak. 57374	Quarry	Hanson.
Steiner-Rausch Granite Co., Inc	Ortonville, Minn. 56278	do	Grant.
Uranium:			
Susquehanna-Western, Inc	Edgemont, S. Dak. 57735	Underground mine.	Fall River.

The Mineral Industry of Tennessee

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Tennessee Division of Geology, for collecting information on all minerals.

By Herbert R. Babitzke,[1] William D. Hardeman,[2] and Robert E. Hershey [3]

The 1972 production of the Tennessee mineral industry was valued at $270 million, an increase of 13% over that of 1971. Tennessee continued to be the leading producing State for ball clay, pyrite, and zinc.

Extensive development and exploration of the zinc ore body in middle Tennessee and the growth of the coal industry to a record $81 million for the year were the most significant aspects of Tennessee's mineral industry in 1972.

Legislation and Government Programs.—On March 23, 1972, Governor Winfield Dunn signed into law the new Tennessee Surface Mining Law, Chapter 547, Public Acts of 1972, which was passed by the State's 87th General Assembly. This new law will produce significant environmental improvement as related to surface mining. The purpose of the act is to provide for the regulation of surface mining and reclamation and revegetation of lands affected by such operations.

Table 1.—Mineral production in Tennessee [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Barite .... thousand short tons..	21	$342	W	W
Cement:				
Portland .... do....	1,713	33,733	1,695	$37,176
Masonry .... do....	159	3,649	176	4,104
Clays [2] .... do....	1,537	6,595	1,718	7,719
Coal (bituminous) .... do....	9,271	59,368	11,260	81,386
Copper (recoverable content of ores, etc.) .. short tons..	13,916	14,473	11,310	11,581
Gold (recoverable content of ores, etc.) .. troy ounces..	192	8	176	10
Natural gas .... million cubic feet..	89	20	25	8
Petroleum (crude) .... thousand 42-gallon barrels..	398	W	198	W
Phosphate rock .... thousand short tons..	2,571	12,151	2,154	10,732
Sand and gravel .... do....	8,018	11,845	10,839	15,828
Silver (recoverable content of ores, etc.) thousand troy ounces..	131	203	83	141
Stone .... thousand short tons..	32,369	48,665	35,942	55,512
Zinc (recoverable content of ores, etc.) ... short tons..	119,295	38,413	101,722	36,111
Value of items that cannot be disclosed: Clay (fuller's earth), lime, pyrites, and values indicated by the symbol W	XX	10,197	XX	10,006
Total	XX	239,662	XX	269,814
Total 1967 constant dollars	XX	203,785	XX	p 224,458

p Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fuller's earth; included with "Value of items that cannot be disclosed."

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[3] State geologist, Department of Conservation, Division of Geology, Nashville, Tenn.

Table 2.—Value of mineral production in Tennessee, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Anderson	W	W	Coal, stone.
Bedford	$420	W	Stone.
Benton	W	W	Sand and gravel, stone.
Bledsoe	246	W	Coal.
Blount	W	W	Stone.
Bradley	W	W	Do.
Campbell	15,437	$16,225	Coal, stone, sand and gravel.
Cannon	W	W	Stone.
Carroll	--	W	Clays.
Carter	W	W	Stone.
Claiborne	12,826	W	Coal, stone.
Clay	W	W	Stone, petroleum.
Cocke	--	W	Stone.
Coffee	W	W	Do.
Cumberland	1,942	2,515	Stone, sand and gravel, coal.
Davidson	11,195	13,212	Stone, cement, clays.
Decatur	W	W	Stone, sand and gravel.
De Kalb	224	231	Stone.
Dickson	W	W	Do.
Fayette	W	W	Stone, sand and gravel.
Fentress	1,032	2,883	Coal, stone, petroleum.
Franklin	4,466	5,142	Cement, stone, sand and gravel, clays.
Gibson	W	W	Sand and gravel.
Giles	1,224	968	Stone, phosphate rock.
Grainger	143	35	Stone.
Greene	W	W	Stone, sand and gravel.
Grundy	W	W	Coal, sand and gravel, stone.
Hamblen	W	W	Stone.
Hamilton	16,087	16,651	Cement, stone, sand and gravel coal, clays.
Hancock	W	W	Zinc, stone.
Hardeman	W	W	Sand and gravel.
Hardin	W	W	Sand and gravel, stone.
Hawkins	W	W	Stone, sand and gravel.
Haywood	7	W	Sand and gravel.
Henderson	W	W	Do.
Henry	W	2,568	Clays.
Hickman	W	W	Phosphate rock.
Humphreys	W	W	Stone, sand and gravel.
Jefferson	26,911	26,981	Zinc, stone.
Johnson	W	W	Stone.
Knox	20,132	22,347	Cement, zinc, stone, lime, sand and gravel, clays.
Lauderdale	74	W	Sand and gravel.
Lawrence	--	W	Stone.
Lincoln	W	W	Stone, barite.
Loudon	408	W	Stone, clays, sand and gravel.
McMinn	444	W	Stone, sand and gravel.
McNairy	W	W	Sand and gravel.
Macon	W	W	Stone.
Marion	W	W	Cement, coal, stone.
Marshall	W	W	Stone.
Maury	W	W	Phosphate rock, stone.
Meigs	W	W	Stone.
Monroe	W	759	Stone, barite, sand and gravel.
Montgomery	W	W	Stone.
Moore	W	30	Do.
Morgan	2,820	3,626	Coal, petroleum, natural gas.
Obion	W	W	Sand and gravel.
Overton	W	460	Stone, petroleum, coal.
Perry	W	182	Sand and gravel.
Pickett	71	W	Stone, petroleum.
Polk	23,782	20,232	Copper, pyrites, zinc, silver, sand and gravel, gold.
Putnam	2,097	1,410	Stone, coal, sand and gravel.
Rhea	W	W	Stone, coal, clays.
Roane	W	W	Stone, coal.
Robertson	W	W	Stone.
Rutherford	940	W	Do.
Scott	4,510	11,574	Coal, petroleum, natural gas.
Sequatchie	W	W	Coal.
Sevier	W	W	Stone, sand and gravel.
Shelby	2,178	4,072	Sand and gravel.
Smith	81	W	Stone.
Stewart	W	W	Sand and gravel, stone.
Sullivan	W	W	Cement, stone, clays.
Sumner	W	W	Stone.
Tipton	W	13	Sand and gravel.
Unicoi	W	W	Do.
Union	1,140	W	Stone.
Van Buren	1,095	W	Coal.
Warren	W	W	Stone.

See footnotes at end of table.

Table 2.—Value of mineral production in Tennessee, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Washington	W	W	Sand and gravel, stone, clays.
Wayne	W	W	Sand and gravel.
Weakley	W	$4,761	Clays.
White	W	1,094	Coal, stone.
Williamson	W	5,360	Phosphate rock, stone.
Wilson	W	W	Stone.
Undistributed [2]	$87,723	106,486	
Total [3]	239,662	269,814	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties are not listed because no production was reported: Cheatham, Chester, Crockett, Dyer, Houston, Jackson, Lake, Lewis, Madison, and Trousdale.

[2] Includes some sand and gravel and stone that cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Tennessee business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total work force thousands	1,742.1	1,831.1	+5.1
Unemployment do	79.4	63.4	−20.2
Total nonagricultural employment do	1,356.6	1,450.4	+6.9
Mining do	7.0	7.2	+2.9
Manufacturing do	460.5	488.3	+6.0
Construction do	68.0	76.2	+12.1
Transportation and public utilities do	67.0	69.3	+3.4
Wholesale and retail trade do	270.1	296.6	+9.8
Finance, insurance, and real estate do	59.2	62.4	+5.4
Services do	192.9	210.2	+9.0
Government do	231.9	240.2	+3.6
Personal income:			
Total millions	$13,183	$14,671	+11.3
Per capita	$3,300	$3,640	+10.3
Construction activity:			
Number of new housing units authorized	36,852	43,335	+17.6
Value of nonresidential construction millions	$271.5	$305.3	+12.4
Cement shipments to and within Tennessee thousand short tons	1,721	1,800	+4.6
Mineral production value millions	$239.7	$269.8	+12.5

[p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

The Tennessee Division of Geology continued its program of quadrangle mapping of geology and mineral resources, and 15 new maps and reports were published for the following quadrangles: Eagle Creek, Hookers Bend, Waynesboro, Paris Landing, Fairview, Martins Mills, Craigfield, Three Churches, Ketner Gap, Wolf Pit Ridge, Whitfield, Lillamay, White Bluff, Chestnut Grove, and Burrville. The mapping program was a cooperative project with the Tennessee Valley Authority (TVA), and about 265 quadrangles and reports have been published since 1962. A new magnetic quadrangle map series was also started and three quadrangles were published: Pleasant Hill, Dorton, and Crossville. In addition, two new special maps[4] and two new technical reports were published.[5] A detailed inventory of mining establishments and mineral processing industries were started with the assistance of grants from the Bureau of Mines and TVA.

The Bureau of Mines Liaison Office in Nashville continued to be involved in a wide variety of informal cooperative mineral-related activities with various State agencies, especially with the Division of Mines (Department of Labor), The Division of Geology and Division of Surface Mining

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[4] Tennessee Division of Geology. Well Location Map of Morgan County, Tenn., 1972.

———. Well Location Map of Scott County, Tenn., 1972.

[5] Luther, E. T., and R. C. Johnson. Strippable coal and the Northern Cumberland Plateau Area of Tenn. Div. Geol., RI 34, 1972, 41 pp.

Miller, R. A., and S. W. Maher. Geologic Evaluation of Sanitary Landfill Sites in Tennessee. Tenn. Div. Geol., Environmental Geology Series, No. 1, 1972, 38 pp.

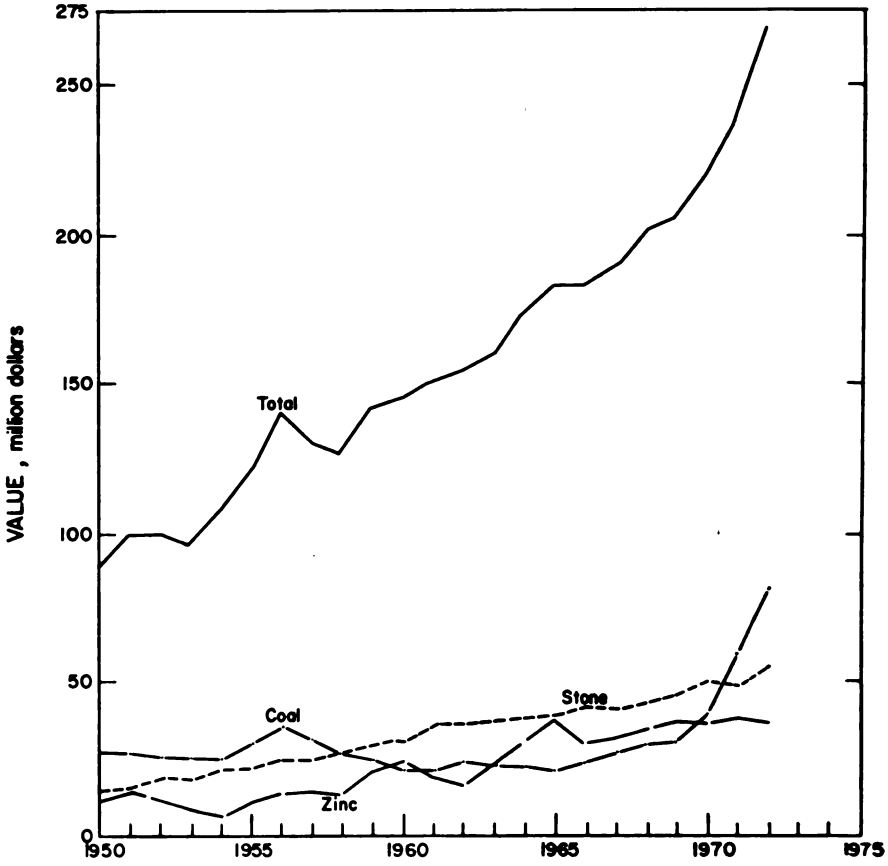

Figure 1.—Value of stone, coal, zinc, and total value of mineral production in Tennessee.

(Department of Conservation), and the Division of Water Quality Control, Division of Air Pollution Control, and Division of Environmental Sanitation (Department of Public Health). A close working relationship was also maintained with several branches of TVA and the U.S. Geological Survey (USGS).

TVA continued construction on three major powerplants: The Sequoyah nuclear plant, the Raccoon Mountain pumped storage project near Chattanooga, and the Cumberland coal-fired steam plant near Dover in northwest Tennessee. The first unit of the Raccoon Mountain project was scheduled to be in operation in November 1974, and the first unit of Sequoyah in December 1975. The Cumberland plant was completed in 1972. Construction began on a new plant, the Watts Bar nuclear plant near Knoxville, with completion scheduled for 1978. Construction continued on the Normandy dam on the Duck River in middle Tennessee; completion was slated for January 1976.

The Geologic Branch of TVA continued

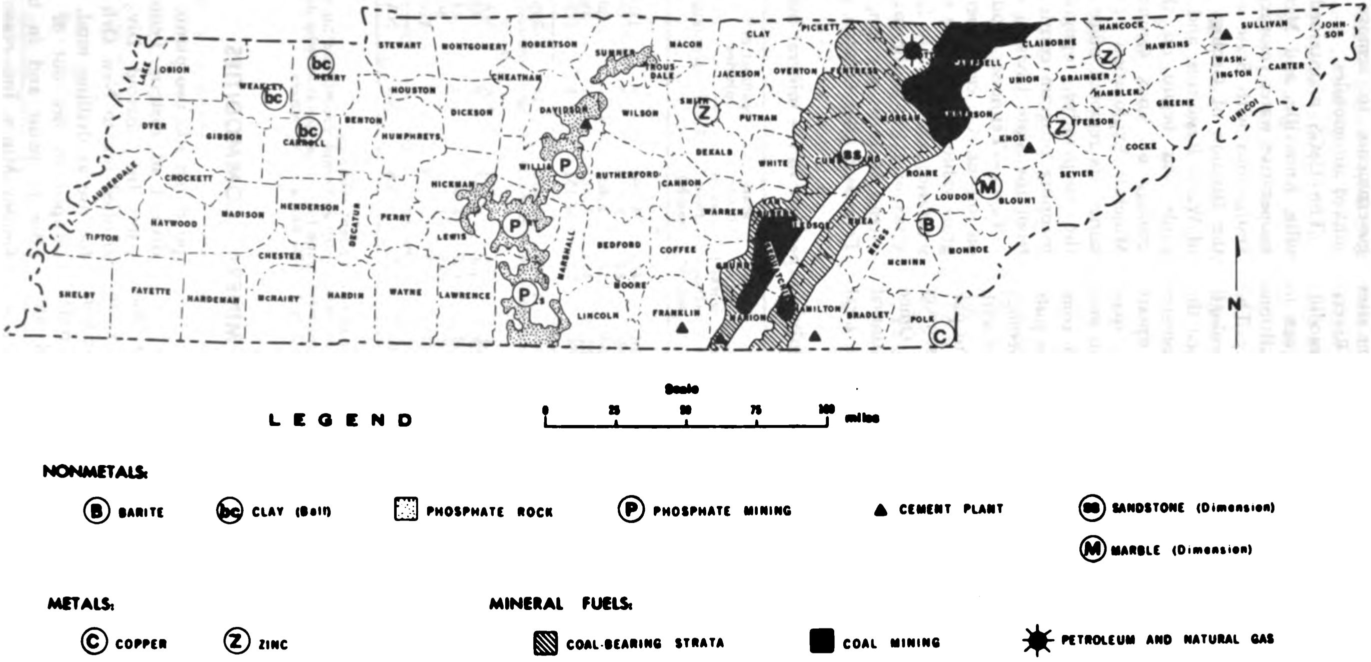

Figure 2.—Generalized map of selected mining areas and industries in Tennessee.

to investigate potential thermal power sites along the Tennessee and Cumberland Rivers. Another investigation began using modifications of oil well logging techniques to study subsurface foundation conditions instead of using drill cores exclusively. The Mineral Resources Section of the Geologic Branch of TVA installed and operated the proton-procession airborne magnetometer purchased in 1971 and flew 4,000 square miles of magnetic coverage on 1-mile spacing in the Upper Cumberland Plateau area of the State. Data were compiled by computer, and the resulting maps will be published by the Tennessee Division of Geology as a cooperative project. An agreement with the USGS was made for this section to participate in the Computerized Resources Information Bank (CRIB). The TVA Office of Tributary Area Development continued its program of cooperation with local governments to remove and dispose of junked automobiles.

The USGS maintained offices in Nashville, Knoxville, and Memphis to conduct cooperative water resource and geologic investigations with State agencies, primarily the Division of Geology and the Division of Water Resources, and during the year a study was begun on the environmental geology of Knox County. The Office of Minerals Exploration of the USGS maintained its regional office in Knoxville and the cooperative topographic quadrangle mapping program continued with support from the State Division of Geology.

Taxes.—Tennessee had a privilege tax on oil of 4.2 cents per barrel and 5% gross value on gas. The state passed a coal severance tax bill in 1972, which levied a tax of 1½% of the market value, not to exceed 10 cents per ton, of coal mined in Tennessee after October 1, 1972.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	2,116	216	458	3,794	8	110	31.10	NA
Metal	1,741	259	451	3,610	5	97	28.26	12,085
Nonmetal	813	254	206	1,697	—	33	19.45	668
Sand and gravel	614	251	154	1,361	—	36	26.45	918
Stone	2,755	264	726	6,151	3	123	20.49	3,787
Total [1]	8,039	248	1,996	16,612	16	399	24.98	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	1,570	259	406	3,245	2	63	20.03	4,606
Nonmetal	485	262	127	1,079	1	41	38.92	6,808
Sand and gravel	455	253	115	1,017	—	36	35.38	963
Stone	2,165	269	583	5,019	2	129	26.10	4,913
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Nonmetals accounted for 52% of the total mineral production value in Tennessee, an increase of 11% over that of 1971. The four principal nonmetallic commodities in order of value were stone, cement, sand and gravel, and phosphate rock.

Barite.—Two companies operated open pit mines and two plants in the Sweetwater district of eastern Tennessee. NL Industries, Inc., Baroid Div., shipped all its crushed ore to New Orleans to be ground for use as drilling mud, and B. C. Wood shipped its ore out of State for use as filler in paint and in barium chemicals. Godsey Mines, Inc. ceased production and had no output during 1972. Both production and value of barite declined from that of 1971. Permits were issued by the Tennessee Department of Conservation, Division of Surface Mining, allowing 3 acres of land to be disturbed for barite recovery in 1972.

Cement.—Portland cement was produced by four companies at six plants, and masonry cement was produced at five plants. Total value of portland cement production rose to $37 million in 1972, a 10% increase over that of 1971. Masonry cement production was valued at $4.1 million, a 12% increase over that of 1971.

Raw materials used were limestone, clay and shale, sand, gypsum, and iron-bearing materials. About 64% of the portland cement was consumed for ready-mix concrete; 21% was used for concrete products; 7% for building materials; and 8% for contractors and other uses. Types of portland cement shipped included types I and II (general use and moderate heat), type III (high-early-strength), white, slag-pozzolan, expansive, waterproof, and other. Types I and II comprised 99% of all the portland cement produced.

Clays.—Tennessee ranked first in the Nation in the production of ball clay by producing 64% of the U.S. total. The clay industry also produced fire clay, fuller's earth, and miscellaneous clays. Permits were issued allowing 254 acres of land to be disturbed for clay removal in 1972.

Ball clay production was 431,126 short tons valued at $6.4 million. This clay was mined at open pits in Carroll, Henry, and Weakley Counties for use in crockery, other earthenware, electrical porcelain, fine china, dinnerware, firebrick, blocks and shapes, glazes, glass, enamels, kiln furniture, pestisides and related products, pottery, rubber, asphalt emulsion, sanitary ware, asphalt tile, floor and wall tile, quarry tile, and ceramics. Some items such as ceramics, sanitary ware, and floor and wall tile were exported.

Fuller's earth production and value were up from that of 1971 while the price remained constant. This clay was mined in Henry County by open pit methods for use as animal litter, floor absorbents, and pesticides and related products.

Miscellaneous clay production and value were up from that of 1971. Major uses for this clay were for common building and face brick, lightweight aggregate, and cement.

Graphite.—Artificial graphite was produced from petroleum coke by Union Carbide Corp. at its plant near Columbia, Tenn. The graphite was used chiefly in the manufacture of furnace electrodes.

Lime.—Foote Mineral Co. and Williams Lime Mfg. Co. produced lime in Knox County for paper and pulp, water purification, lithium manufacture, and other uses. Output decreased 3% and was 9% below the 1967 record. Total consumption of lime in Tennessee was 136,000 tons.

Mullite.—Electro Minerals Corp. at Greenville produced a small quantity of synthetic mullite in 1972, which was the first time that mullite was produced in the State. All of the product was used for special-duty refractory material.

Perlite.—Chemrock Corp. continued expanding crude perlite at its plant in Nashville. The product was used as filter aids and concrete aggregate.

Phosphate Rock.—Tennessee ranked third in the Nation in phosphate rock production and value. The industry is located in Giles, Hickman, Maury, and Williamson Counties in central Tennessee.

Marketable production was 2,154,428 short tons, a 16% decrease from that of 1971; value decreased 12%. All of the phos-

Table 5.—Tennessee: Ball clay sold or used by producers, by use

(Short tons)

Use	1971	1972
Whiteware, etc	259,321	276,391
Floor and wall tile	78,600	76,820
Other uses	[1] 39,500	[2] 77,915
Total	377,421	431,126

[1] Includes firebrick and block, kiln furniture, insecticides and fungicides, other filler uses, and other uses.

[2] Includes asphalt emulsion; firebrick, block, and shapes; glazes, glass, and enamels; kiln furniture; pesticides and related products; electrical porcelain; rubber; asphalt tile; and exports.

phate rock mined was used as furnace charge in the manufacture of elemental phosphorus.

Production was by three companies and TVA; all was mined by open pit methods and shipped to plants near the mines. Permits were issued by the State allowing 552 acres of land to be disturbed in 1972 for phosphate rock mining.

The phosphate industry was operating at about 80% of capacity, a somewhat greater percentage than in the last few years, during which a number of electric furnaces were inactive. Monsanto Co. was operating five furnaces with one inactive; Stauffer Chemical Co. was operating three furnaces with two inactive; and Hooker Chemical Corp. operated two furnaces with one inactive. Mobil Chemical Co. went out of business by closing down its one furnace. Demand was increasing at yearend, but it was not expected that furnace capacity would be reached before 1975 or 1976.

The Monsanto Co. is building one of the highest earthfill dams in the southeast, about 150 feet high and 3,000 feet long, which will impound a 500-acre lake near Columbia. The lake will serve as a settling basin for phosphate slimes from company washing operations and will furnish water for plant operations in a closed system. Environmental water quality problems resulting from the high clay content of the phosphate ore in the district have plagued the industry for many years. Monsanto Co. is the largest operator in the area, and it is estimated that this basin will serve the company until 1975. The terrain is such that the height of the dam can be increased when necessary.

Pyrite.—Tennessee led the Nation in pyrite output. The only producer was Cities Service Co. at its Copperhill operations. Production tonnage and value both declined slightly from that of last year. Pyrite concentrate recovered by flotation from sulfide ore mined in Polk County was used to produce sulfuric acid, sulfur dioxide, ferric sulfate, and iron sinter. Cities Service Co. sold nearly 1 million tons of sulfuric acid during the year. The company constructed a pelletizing plant at Copperhill, which was essentially completed during 1972, but only trial runs were made late in the year. Plant capacity will be 850,000 to 1 million tons per year. The iron sinter production facilities were closed down during the summer of 1972. Even though the facilities were not dismantled, they were not expected to be used any further. Sinter from the year's production and from accumulated stockpiles were shipped to Alabama for processing.

Sand and Gravel.—Sand and gravel production increased 35% over that of 1971 and value increased 29%.

Shelby County led the State in production in 1972 with 29% of the total produced, followed by Benton County with 13%. Commercial sand and gravel produc-

Table 6.—Tennessee: Sand and gravel sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Benton	8	1,082	1,828	6	1,426	2,275
Decatur	1	W	W	1	166	265
Fayette	4	139	143	2	W	W
Giles	1	208	208	--	--	--
Grundy	1	W	W	1	208	416
Haywood	2	74	7	1	W	W
Lauderdale	1	122	74	1	W	W
Perry	2	W	W	1	182	182
Polk	1	24	70	1	W	W
Shelby	8	1,914	2,178	7	3,111	4,072
Tipton	2	W	W	1	114	13
Undistributed[1]	[r] 34	4,456	7,337	29	5,634	8,107
Total[2]	65	8,018	11,845	51	10,839	15,328

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included in "Undistributed."

[1] Includes Campbell, Cumberland, Franklin, Gibson, Greene, Hamilton, Hardeman, Hardin, Hawkins (1972), Henderson, Humphreys, Knox, Loudon, McMinn, McNairy, Monroe, Obion, Putnam, Sevier, Stewart (1972), Unicoi, Washington, and Wayne Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 7.—Tennessee: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	2,420	3,755	3,314	4,580
Fill	W	W	97	96
Molding	W	W	181	640
Paving	876	1,658	1,620	2,561
Other uses [1]	732	1,922	455	1,445
Total [2]	4,029	7,335	5,667	9,322
Gravel:				
Building	1,498	2,175	2,797	3,403
Fill	50	58	93	110
Paving	1,444	1,457	W	W
Miscellaneous	111	113	259	229
Other uses [3]	110	218	1,625	2,093
Total [2]	3,213	4,022	4,775	5,834
Government-and-contractor operations:				
Sand:				
Paving	7	8	2	2
Total	7	8	2	2
Gravel:				
Building	--	--	38	3
Fill	42	42	--	--
Paving	727	438	358	166
Total	769	480	396	169
Total sand and gravel [2]	8,018	11,845	10,839	15,328

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."

[1] Includes fill (1971), railroad ballast (1971), blast (1971), engine, fire or furnace, glass, grinding and polishing (1972), foundry (1972), and other industrial sands

[2] Data may not add to totals shown because of independent rounding

[3] Includes railroad ballast and other uses

tion accounted for 96% of the total, and the remaining 4% was produced by State and county governments for buildings, and paving. Production during the year came from 51 locations, and permits were issued by the State allowing 302 acres of land to be disturbed for the removal of sand and gravel in 1972.

Benton County continued production of industrial unground sand used for glass and molding, nearly all of which was produced by Hardy Sand Co. for the Ford Motor Co. glass plant in Nashville.

Stone.—Stone, second in value in mineral production, supplied 21% of Tennessee's income from mineral products in 1972. Production was 35.9 million tons valued at $55.5 million, increases of 11% and 14%, respectively, over last year's totals. Davidson County led in production followed by Knox County.

Limestone was produced at 114 quarries, dolomite at two, marble at six, sandstone at three, and quartzite at three for a total of 128 production sites in 63 counties. A total of 79 companies were in operation at the above quarries. Of the 128 sites, 83 produced more than 100,000 tons of stone, and six quarries produced more than 100,000 tons of stone, and six quarries produced more than 900,000 tons in 1972.

Limestone continues to be of the greatest significance in terms of tonnage and value of all the stone produced, 99% and 96%, respectively. End uses for limestone were road base stone (35%), concrete aggregate (14%), bituminous aggregate (7%), cement (7%), and numerous miscellaneous uses (37%). About 80% of the dolomite produced was for agricultural uses.

Dimension marble production was 5,383 tons, down 7% from that of 1971. A large percentage of the dimension marble was used as rough blocks, the remainder was used as cut and sawed stone.

The major uses of dimension sandstone were for house stone veneer and rubble; crushed and broken sandstone was used for

Table 8.—Tennessee: Crushed limestone [1] sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value
Bedford	1	W	420	1	W	W
Campbell	4	700	W	3	W	W
Clay	1	W	W	1	77	118
Davidson	11	4,460	5,491	7	5,030	7,373
De Kalb	1	175	224	1	W	231
Fentress	1	146	201	1	178	262
Franklin	4	1,070	W	4	1,097	W
Grainger	1	80	108	--	--	--
Jefferson	3	678	702	3	826	881
Knox	7	1,815	3,046	7	2,333	4,058
Lawrence	--	--	--	1	88	W
McMinn	1	W	139	2	580	949
Marion	4	W	W	4	1,529	1,644
Moore	1	W	W	1	W	30
Pickett	1	W	71	1	24	36
Rutherford	4	815	940	4	W	W
Smith	1	52	81	1	W	W
Stewart	1	W	W	1	210	261
Union	1	760	1,140	2	W	W
Washington	7	W	W	5	137	240
White	2	W	W	1	164	349
Undistributed [2]	[r] 67	21,406	34,389	65	23,467	36,866
Total	124	32,152	46,952	116	35,740	[3] 53,297

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Limestone used generally to include dolomite.

[2] Includes Anderson, Benton, Blount, Bradley, Cannon, Carter, Claiborne, Cocke (1972), Coffee, Cumberland, Decatur, Dickson, Fayette (1971), Giles, Greene, Grundy, Hamblen, Hamilton, Hancock, Hardin, Hawkins, Humphreys, Johnson, Lincoln, Loudon, Macon, Marshall, Maury, Meigs, Monroe, Montgomery, Overton, Putnam, Rhea, Roane, Robertson, Sequatchie (1971), Sevier, Sullivan, Sumner, Unicoi (1971), Warren, Wayne (1971), Williamson and Wilson Counties, and production for which no county breakdown is available.

[3] Data does not add to total shown because of independent rounding.

Table 9.—Tennessee: Crushed limestone [1] sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Bituminous aggregate	3,132	4,908	2,498	3,707
Concrete aggregate	5,181	7,712	5,115	7,478
Dense graded road base stone	12,695	17,372	12,345	18,361
Macadam aggregate	1,875	2,769	2,245	3,285
Surface treatment aggregate	1,413	2,042	1,713	2,566
Unspecified aggregate and roadstone	2,331	3,485	4,715	6,856
Agricultural limestone [2]	1,391	1,907	2,541	3,913
Cement and lime manufacture	2,437	3,645	2,474	3,266
Fill	--	--	50	88
Railroad ballast	W	W	120	W
Riprap and jetty stone	123	206	825	1,262
Stone sand	112	198	85	103
Other uses [3]	1,512	2,709	1,016	2,412
Total [4]	32,152	46,952	35,740	53,297

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Limestone used generally to include dolomite.

[2] Data includes poultry grit and other soil conditioners (1971).

[3] Includes fluxing stone, drain fields, other fillers (1972), chemical stone (1971), chemicals (1972), roofing aggregate, filter stone (1971), glass, and uses not specified.

[4] Data may not add to totals shown because of independent rounding.

Table 10.—Tennessee: Mine production (recoverable) of gold, silver, copper and zinc

	1970	1971	1972
Mines producing: Lode	13	13	11
Material sold or treated:			
Ore thousand short tons	5,837	[1] 5,948	5,285
Copper-zinc do	1,680	1,704	1,762
Zinc do	4,157	4,245	3,523
Production (recoverable):			
Quantity:			
Gold troy ounces	124	192	176
Silver do	94,770	131,349	83,466
Copper short tons	15,585	13,916	11,310
Zinc do	118,260	119,295	101,722
Value:			
Gold thousands	$5	$8	$10
Silver do	168	203	141
Copper do	17,928	14,473	11,581
Zinc do	36,233	38,413	36,111
Total do	[1] 54,333	53,097	47,843

[1] Data may not add to totals shown because of independent rounding

asphalt fill and production of glass and ferrosilicon. Major uses for quartzite were to produce irregularly shaped stone and house stone veneer.

Vermiculite.—Construction Products Div. of W. R. Grace & Co. at Nashville continued expanding crude vermiculite from Montana and South Carolina. Vermiculite was used for concrete aggregate, plaster aggregate, loose fill aggregate, and horticulture.

METALS

Metals accounted for 18% of the total value of mineral production in 1972. Zinc production accounted for 75% of metal value and copper accounted for most of the remainder. Total value of metal production was down 11% from that of last year.

Aluminum.—Tennessee ranked fifth in the Nation in quantity and value of aluminum produced in 1972. Production was down 12% from that of 1971. The Aluminum Co. of America (Alcoa) in Blount County and Consolidated Aluminum Corp. (Conalco) in Humpherys County produced aluminum metal from alumina imported from outside the State.

During 1972 the capacity of the Alcoa plant was increased from 200,000 to 270,000 tons per year. Environmental control emphasis continued during the year and additional smelting lines were equipped with the high-efficiency Alcoa 398 process for fume control. The process was used on the second 100,000-ton potline.

The rated capacity of Conalco remained the same as in 1971 at 140,000 short tons; however, in 1972 the plant operated at somewhat less than capacity.

Copper.—Cities Service Co., at its Copperhill operations in Polk County, was the only producer of copper in the State. The company recovered copper concentrate from sulfide ore. The copper mining belt is 2 by 6 miles with mining to a depth of 3,400 feet. Production is from four mines, the Cherokee, Boyd, Calloway, and Eureka mines, with hoisting from three shafts and the Eureka slope. The Cherokee is the biggest and the Calloway is being deepened. Mining operations were at capacity throughout the year. Copper metal production in 1972 was 11,310 short tons valued at $11.6 million, a decline of 19% in quantity and 20% in value from the previous year's totals.

Copper concentrates of 20% metal were smelted in the electric furnaces and converters. Blister cakes were made, but about half of the blister was converted to copper shot, which was subsequently converted to copper sulfate by treatment with sulfuric acid.

Gases from the smelter and roasters were treated to make sulfuric acid. Some of the acid was used in the plant and the remainder was sold throughout the Southeast.

The multimillion-dollar expansion and modernization of manufacturing facilities at Copperhill were essentially completed in 1972. The program was designed to improve production and bring the operation within the air quality laws. Mining and milling have increased from 5,000 to 6,900 tons per day of ore. A new electric furnace was installed to supply matte to two converters; new roasters and a pelletizing plant were constructed near the Copperhill smelter, and a new 1,800-ton-per-day contact sulfuric acid plant was built.

Ferroalloys.—Six companies produced ferroalloys in Marion, Maury, Roane, and Shelby Counties. The plants in Maury County produced ferrophosphorus as a byproduct in making phosphorus; the plant in Marion County produced ferrosilicon; the plant in Roane County produced ferromanganese, ferrosilicon, and silicomanganese; and the Shelby County plant produced ferromanganese, ferrosilicon, silicomanganese, ferrochromium, and ferrochromiumsilicon.

Shipments of ferroalloys in 1972 were 217,000 tons valued at $33.9 million. Value per ton decreased from that of last year by 15%.

During the year, International Utilities Corp. purchased Tennessee Metallurgical Co., which had production of about 30,000 tons of ferrosilicon per year and some silicon metal. Headquarters were in Chattanooga and the plant was located at Kimball in Marion County.

Gold.—Gold recovered at out-of-State refineries was a byproduct of refined copper from the Cities Service Co. Copperhill operations. The yield decreased from 192 troy ounces to 176 troy ounces in 1972; however, with the increase in the price of gold during the year, the production value increasd from $7,920 in 1971 to $10,314 in 1972.

Magnesium.—Tennessee Die Casting Corp. at Ripley expanded its facilities to produce magnesium die castings. The company planned to expand its Ripley, Tenn., facilities by 8,000 square feet.

Manganese.—Foote Mineral Co. made production improvements during the year at its electrolytic manganese plant in New Johnsonville. The improvements partially offset increased labor, raw material, and power costs. Sales of electrolytic manganese in chip form and in the form of manganese-aluminum briquets increased moderately over 1971 levels.

Silver.—Silver recovered at out-of-State refineries was a byproduct of refining copper from the Cities Services Co. Copperhill operations. Quantity and value of silver produced both decreased from that of last year—quantity declined 36% to 83,466 troy ounces and value declined 31% to $140,640.

Titanium.—E. I. duPont de Nemours and Co., Inc., continued production of titanium dioxide pigments from concentrates from Florida, Georgia, New Jersey, and Australia. Capacity of the New Johnsonville plant was increased by 45,000 tons per year during the first quarter of 1972, which brought the annual capacity of the plant to 141,000 tons. Further expansion is underway for another 55,000 tons per year with expected completion for 18,000 tons planned for midyear 1973 and 37,000 tons by yearend 1973. In order to dispose of the effluent (aqueous solution of ferric chloride) produced, three deep waste disposal holes have been drilled into the Knox Dolomite since 1967. Initially 250 to 300 gallons per minute were being injected into the subsurface below 3,000 feet. Except for short shutdown periods, injection of this effluent at about the same rate has continued over the approximate 5 year period. Hole 1 has been abandoned. Holes 2 and number 3 are presently operative. Plans are being made to drill Hole 4.

Zinc.—Tennessee led the Nation in zinc production for the 15th consecutive year with 101,722 short tons, 21% of the zinc produced in the United States. Value of zinc produced was $36.1 million which ranked fourth in all the minerals produced in the State for 1972.

Three companies mined zinc ore from seven mines in Hancock, Jefferson, and Knox Counties in eastern Tennessee. Cities Service Co. Copperhill operations also produced zinc concentrates from its plant in Polk County.

The American Smelting and Refining Company (ASARCO) temporarily closed its Coy mine near Jefferson City in August. This mine went into full production in January 1959, but output decreased gradually over the last few years. The Mascot Mill, which has operated since 1913, is being replaced by a new mill with 20% more capacity at the Young mine. Scheduled completion date for the new mill will be mid-1974. This mill will process ore from the Young, Coy, and Immel mines. The ore from the New Market mine was processed at its own mill. Zinc reserves at ASARCO Tennessee mines have been estimated at over 77 million tons of ore averaging 3% to 4% zinc. Two valuable mill products are marketed by ASARCO American Limestone Co. The tailings were used for agricultural limestome and the sink-float reject was sold for gravel.

The New Jersey Zinc Co. closed the Flat Gap mine in Hancock County near Treadway on October 1, 1972. This mine had been in operation since 1959. The company reported that all equipment, including the mill would be moved to its new Elmwood mine near Carthage. The company had been exploring the Elmwood ore body by underground methods for more than a year and development work was continuing. The production shaft was more than 450 feet in depth. The shaft is 16 feet in diameter and will be concrete lined to a depth of 1,550 feet. Underground development work from the exploration shaft continued and underground rail haulage was being developed. Production was planned to begin about mid-1974 at the rate of about 2,000 tons per day. The announcement of this discovery several years ago touched off widespread exploration activity in Tennessee with more than 1.5 million acres under lease at one time in the middle Tennessee area.

The Jefferson City mine of New Jersey Zinc Co. and the Zinc Mine Works of United States Steel Corp. in east Tennessee operated throughout the year.

Ball Metal and Chemical Div. of Ball Corp., Greeneville, Tenn., began operation of what was reported to be one of the worlds' largest zinc rolling mills. This plant was planned to consume 25,000 to 30,000 tons of zinc annually and produce dry cell battery cans and photoengraving plates.

MINERAL FUELS

Mineral fuels accounted for 30% of the total value of mineral production in 1972. Value of production was up 35% from that of 1971 and coal accounted for most of the output.

Coal (Bituminous).—For the second consecutive year, coal was the major mineral commodity produced in Tennessee in terms of value with 11 million short tons valued at $81 million in 1972. Quantity and value increased 21% and 37%, respectively, over last year's totals. Production was from 211 mines in 18 counties in the Cumberland Plateau region of east-central Tennessee. Underground mining accounted for 52% of the total production, strip mining for 45%, and auger mining for the remaining 3%.

During the year, 21.4 million tons of coal, of which 10.4 million tons were imported, were distributed as follows: 88% to electrical

Table 11.—Tennessee: Bituminous coal production, by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total[1]	
Anderson	25	22	5	52	1,348	1,318	120	2,786	$20,616
Bledsoe	--	2	--	2	--	W	--	W	W
Campbell	20	13	2	35	885	935	135	1,956	14,587
Claiborne	5	10	--	15	1,471	907	--	2,378	16,837
Cumberland	2	3	--	5	11	17	--	28	197
Fentress	2	7	--	9	25	387	--	412	2,617
Grundy	--	6	--	6	--	182	--	182	1,327
Hamilton	2	1	--	3	W	W	--	W	W
Marion	17	3	--	20	644	33	--	676	4,662
Morgan	6	8	1	15	88	407	12	507	3,602
Overton	--	1	--	1	--	W	--	W	W
Putnam	1	--	--	1	W	--	--	W	W
Rhea	2	--	--	2	W	--	--	W	W
Roane	--	1	--	1	--	W	--	W	W
Scott	18	14	1	33	991	440	14	1,445	11,020
Sequatchie	5	1	--	6	W	W	--	W	W
Van Buren	1	2	--	3	W	W	--	W	W
White	2	--	--	2	95	--	--	95	745
Undistributed	--	--	--	--	307	488	--	795	5,176
Total[1]	108	94	9	211	5,866	5,113	281	11,260	81,386

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Data may not add to totals shown because of independent rounding.

utilities, 1% to coke and gas plants, 2% to retail dealers, and 9% to others.

Permits were issued by the State of Tennessee allowing 4,709 acres of land to be disturbed for coal strip mining in 1972.

Coke.—Chattanooga Coke and Chemicals Div. of Woodward Co., The Mead Corp. produced all the State's coke and breeze at its plant at Alton Park. Other commodities produced were ammonium sulfate, crude coal tar, crude light oil, benzene, toluene, and xylene. The coal used for production of coke and byproducts was from Pennsylvania, Virginia, and West Virginia.

Natural Gas.—Standard Explorations Co. and Pemberton Oil and Lumber Co., Inc., both of Oneida, Tenn., were the leading producers of natural gas in 1972. Natural gas sold in 1972 totaled 24.6 million cubic feet, all from Scott and Morgan Counties, a 73% decrease from that of last year.

Petroleum.—Crude oil production for 1972 was 198,234 barrels, down about 200,000 barrels from that of 1971. The Oneida West field in Scott County produced 165,874 barrels from a total of 37 wells in 1972, and cumulative production totaled 868,923 barrels by yearend. By July 1972, monthly production had declined to about 10,500 barrels, but by December had increased to 18,000 barrels from 32 wells.

Tennessee had a total of 94 oil and gas test wells drilled in 1972, down 45% from that of 1971. Seventeen counties had one or more wells, but most of the activity was in Scott, Morgan, Fentress, Overton, and Clay Counties. These five counties had a total of 80 wells, of which 55 were exploratory. Only three test wells were drilled west of the axis of the Nashville dome. Total footage for all tests was 107,970 feet, of which 80,288 feet was exploratory.

New regulations pertaining to oil and gas operations in Tennessee became effective November 15, 1972.

Three oil fields and one gas field were discovered in 1972. Except for one small Ordovician field in Clay County, all exploratory successes were in Scott, Morgan, and Fentress Counties, and all were completed in Mississippian carbonates.

The most significant find was in the Fort Payne Formation at the Honey Creek South field in Scott County. By yearend five oil wells had been completed on 40-acre spacings and nearly 12,000 barrels of oil had been sold from the lease. The field is about 5 miles southwest of the Oneida West field and pay depth and geology of the fields were similar.

Table 12.—Tennessee: Oil and gas well drilling completions, by county

	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Clay	1	--	2	1	--	13	17	13,479
Cumberland	--	--	--	--	--	1	1	1,900
Fentress	1	--	--	--	4	9	14	13,167
Hamilton	--	--	--	--	--	2	2	1,557
Henry	--	--	--	--	--	1	1	6,500
Hickman	--	--	--	--	--	1	1	805
Jackson	--	--	1	--	--	--	1	506
Lewis	--	--	--	--	--	1	1	743
Lincoln	--	--	--	--	--	1	1	142
Macon	--	--	1	--	--	1	2	1,805
Morgan	--	--	2	2	1	4	9	12,755
Overton	1	--	7	--	--	6	14	10,931
Putnam	--	--	--	--	--	1	1	600
Scott	7	2	2	1	2	12	26	42,021
Smith	--	--	--	--	--	1	1	232
White	--	--	--	--	--	1	1	427
Wilson	--	--	--	--	--	1	1	400
Total	10	2	15	4	7	56	94	107,970

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 13.—Principal producers

Commodity and company	Address	Type of activity	County
Aluminum smelters:			
Aluminum Co. of America	P.O. Box 158 Alcoa, Tenn. 37701	Plant	Blount.
Consolidated Aluminum Corp. New Johnsonville.	1102 Richmond St. Jackson, Tenn. 38301	do	Humphreys.
Barite:			
NL Industries, Inc., Baroid Division.	Box 187 Sweetwater, Tenn. 37874	2 open pit mines and plant.	Monroe.
B. C. Wood	Box 284 Sweetwater, Tenn. 37874	Open pit mine and plant.	Loudon.
Cement:			
General Portland Inc., Signal Mountain Division.	1300 American National Bank Bldg. Chattanooga, Tenn. 37402	Plant	Hamilton.
Ideal Cement Co	P.O. Box 6238 Knoxville, Tenn. 37914	do	Knox.
Marquette Cement Mfg. Co	P.O. Box 1242 Nashville, Tenn. 37202	do	Davidson.
	P.O. Box 157 Cowan, Tenn. 37318	Open pit mine and plant.	Franklin.
Penn-Dixie Cement Corp	Richard City, Tenn. 37371	Plant	Marion.
	Kingsport, Tenn. 37662	do	Sullivan.
Clay:			
Ball:			
Bell Clay Co	Gleason, Tenn. 38229	4 open pit mines and plant.	Weakley.
Kentucky-Tennessee Clay Co	Box 449 Mayfield, Ky. 42066	13 open pit mines and plant.	Carroll, Gibson, Henry, Weakley.
H. C. Spinks Clay Co., Inc	Box 820 Paris, Tenn. 38242	16 open pit mines and plants.	Carroll, Henry, Weakley.
United Sierra, Div. Cyprus Mines Corp.	P.O. Box 111 Gleason, Tenn. 38229	7 open pit mines and plant.	Carroll and Weakley.
Fuller's earth:			
Southern Clay, Inc. (Subsidiary of Lowe's Inc.)	Box 819 Paris, Tenn. 38242	Open pit mine and plant.	Henry.
Miscellaneous:			
General Portland Cement Co	1300 American National Bank Bldg. Chattanooga, Tenn. 37402	do	Hamilton.
General Shale Products Corp	Box 3547 C.R.S. Johnson City, Tenn. 37601	6 open pit mines and plants.	Hamilton, Knox, Sullivan, Washington.
Shalite Corp	Box 441 Knoxville, Tenn. 37901	Open pit mine and plant.	Knox.
Tennlite, Inc	Box 340 Greenbrier, Tenn. 37073	do	Davidson.
Coal:			
Consolidation Coal Co	Box 460 Middlesboro, Ky. 40965	1 underground mine and plant.	Claiborne.
Howard Ensley Coal Co., Inc	Rt. 1, Box 49B Newcomb, Tenn. 37819	1 strip mine	Scott.
Farrell Mining Co	Box 7 Elk Valley, Tenn. 37734	1 auger and 2 strip mines.	Campbell.
Grundy Mining Co., Inc	P.O. Box 878 Jasper, Tenn. 37347	1 underground mine.	Marion.
Oliver Springs Mining Co., Inc	Box 350 Oliver Springs, Tenn. 37840	3 underground mines.	Anderson.
Volunteer Mining Corp	Cody, Ky. 41808	Underground mine.	Do.
Coke:			
Chattanooga Coke and Chemicals Div. of Woodward Co., The Mead Corp.	4800 Central Ave. Chattanooga, Tenn. 37410	Plant	Hamilton.
Copper:			
Cities Service Co., Copperhill Operations.	Copperhill, Tenn. 37317	4 underground mines, mill, smelter, chemical plant.	Polk.
Ferroalloys:			
Chromium Mining and Smelting Co	P.O. Box 28538 Memphis, Tenn. 38128	Plant	Shelby.
Hooker Chemical Corp	P.O. Box 591 Columbia, Tenn. 38401	do	Maury.
Monsanto Co	Columbia, Tenn. 38401	do	Do.
Roane Electric Furnace, Woodward Co., Div. The Mead Corp.	Box 298 Rockwood, Tenn. 37854	do	Roane.
Stauffer Chemical Co	P.O. Box 472 (Furnace Plant) Mt. Pleasant, Tenn. 38474	do	Maury.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Graphite, artificial:			
Union Carbide Corp	P.O. Box 513 Columbia, Tenn. 38401	Plant	Maury
Lime, primary:			
Foote Mineral Co	Rt. 8, Asbury Rd. Knoxville, Tenn. 37914	Lime kiln	Knox.
Williams Lime Mfg. Co	Box 2286 Knoxville, Tenn. 37901	do	Do.
Perlite, expanded:			
Chemrock Corp	Osage St. Nashville, Tenn. 37208	Plant	Davidson.
Petroleum:			
E. J. Clowes & William Ray	P.O. Box 199 Oneida, Tenn. 37841	2 wells	Scott.
C. G. Collins	P.O. Box 370 Greenburg, Ky. 42743	3 wells	Do.
Green River Gas Co	P.O. Box 420 Oneida, Tenn. 37841	4 wells	Do.
Tenexco Co	P.O. Box 290 Oneida, Tenn. 37841	3 wells	Do.
Irvin Vawter	Box 223 Albany, Ky. 42602	5 wells	Do.
Petroleum Refinery:			
Delta Refinery Co. Div. of Earth Resources Co.	543 W. Mallory Ave. Memphis, Tenn. 38106	Refinery	Shelby.
Phosphate rock:			
Hooker Chemical Corp	Box 591 Columbia, Tenn. 38401	Open pit mines and plant.	Hickman and Maury.
Monsanto Co	800 North Lindbergh Blvd. Columbia, Tenn. 38401	do	Giles, Maury, Williamson.
Stauffer Chemical Co	P.O. Box 89 Mt. Pleasant, Tenn. 38474	do	Giles and Maury.
Tennessee Valley Authority	P.O. Box 73 Columbia, Tenn. 38401	do	Maury and Williamson.
Pyrite:			
Cities Service Co., Copperhill Operations.	Copperhill, Tenn. 37317	*See* copper	Polk.
Sand and gravel:			
Camden Gravel Co	P.O. Box 207 Camden, Tenn. 38320	Open pit	Benton.
Dixie Sand & Gravel Co	515 River St. Chattanooga, Tenn. 37402	Open pit and dredge.	Hamilton.
Fischer Concrete Co., Inc	P.O. Box 37 Memphis, Tenn. 38126	3 open pits	Shelby.
W. S. Jordan & Sons Sand & Gravel Inc.	Box 16142 Memphis, Tenn. 38116	do	Do.
Memphis Stone & Gravel Co	Box 269 Germantown, Tenn. 38138	2 open pits	Benton and Shelby.
Clyde Owen Sand and Gravel Inc	10636 Shelton Road Collierville, Tenn. 38017	Open pit	Shelby.
Tennessee Valley Sand and Gravel Co.	Box 520 Sheffield, Ala. 35660	Dredge	Hardin.
Silver:			
Cities Service Co., Copperhill Operations.	Copperhill, Tenn. 37317	*See* Copper	Polk.
Stone:			
Dolomite:			
Agricultural Lime Co. Inc	R.F.D. 9 Greeneville, Tenn. 37743	Open quarry	Greene.
New Jersey Zinc Co. (Gulf Western Industries Inc.)	Jefferson City, Tenn. 37760	Underground mine.	Jefferson.
Limestone, crushed:			
American Smelting & Refining Co.	Watauga, Tenn. 37694	Open quarry	Carter.
Dalton Rock Prod. Co	P.O. Box 1352 Cleveland, Tenn. 37311	do	Bradley.
Hoover Co	Box 7201 Nashville, Tenn. 37210	5 quarries	Cumberland, Davidson, Franklin, Robertson, Rutherford.
Ralph Rogers & Co	720 Argyle Ave. Nashville, Tenn. 37203	2 open quarries and 1 underground mine.	Anderson, Coffee, Sumner.
The Stone Man, Inc	P.O. Box 2098 3814 Tennessee Ave. Chattanooga, Tenn. 37409	5 open quarries	Bedford, Hamilton, Moore, Rutherford, Warren.

Table 13.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone:—Continued			
Limestone, crushed—Continued			
Vulcan Materials Co	Box 7 Knoxville, Tenn. 37901	25 open quarries	Anderson, Benton, Blount, Davidson, Decatur, Hamblem, Hamilton, Hardin, Hawkins, Humphreys, Knox, Loudon, Marion, Roane, Rutherford, Sevier, Sullivan, Sumner, Wayne, Williamson.
Marble:			
John J. Craig Co	681 Maryville Pike SW Knoxville, Tenn. 37920	2 open quarries	Blount.
Georgia Marble Co	Riverside Drive Knoxville, Tenn. 37914	Open quarry	Union.
Imperial Black Marble Corp	Thorn Hill, Tenn. 37881	do	Grainger.
Quartzite:			
Ross L. Brown Cut Stone Co., Inc.	Crab Orchard, Tenn. 37723	do	Cumberland.
Crab Orchard Stone Co., Inc	P.O. Drawer J. Crossville, Tenn. 38555	do	Do.
Crossville Stone Co	Box 426 Crossville, Tenn. 38555	do	Fentress.
Sandstone:			
Crab Orchard Stone Co., Inc	P.O. Drawer J. Crossville, Tenn. 38555	do	Cumberland.
Turner Bros. Stone Co., Inc	P.O. Box 297 Crossville, Tenn. 38555	do	Do.
White Silica Sand Co., Inc	Rt. 2 Caryville, Tenn. 37714	do	Campbell.
Vermiculite, exfoliated:			
W. R. Grace & Co., Construction Products Div.	4061 Powell Ave. Nashville, Tenn. 37204	Plant	Davidson.
Zinc:			
American Smelting & Refining Co	Mascot, Tenn. 37806	4 underground mines and mill.	Jefferson and Knox.
Cities Service Co., Copperhill Operations.	Copperhill, Tenn. 37317	*See* copper	Polk.
New Jersey Zinc Co., (Gulf & Western Industries, Inc.)	Jefferson City, Tenn. 37760	Underground mine and mill.	Jefferson.
United States Steel Corp	Jefferson City, Tenn. 37760	do	Do.

The Mineral Industry of Texas

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Bureau of Economic Geology, the University of Texas at Austin, for collecting information on all minerals except fuels.

By S. O. Wood, Jr.[1] and Roselle Girard[2]

Mineral output in 1972 attained an all-time record high value of $7.2 billion, and Texas continued as the Nation's leader for the 38th consecutive year. The State ranked first in production of petroleum, natural gas, natural gas liquids, natural graphite, magnesium metal, and recovered sulfur. Important quantities of helium, sulfur (produced by the Frasch method), lime, gypsum, clays, sand and gravel, salt, metallic sodium, and uranium were also produced. Mineral production was obtained from 233 of the State's 254 coun-

Table 1.—Mineral production in Texas[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland .... thousand short tons..	7,198	$140,206	7,818	$171,642
Masonry .... do....	169	4,514	217	5,312
Clays .... do....	4,615	10,432	5,175	11,554
Coal .... do....	W	W	4,045	W
Gem stones	NA	155	NA	163
Gypsum .... thousand short tons..	1,308	4,806	1,542	5,284
Helium:				
Crude .... million cubic feet..	1,208	14,496	1,026	12,312
High-purity .... do....	50	1,750	--	--
Lime .... thousand short tons..	1,612	24,583	1,631	22,181
Natural gas .... million cubic feet..	8,550,705	1,376,664	8,657,840	1,419,886
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels..	96,286	299,981	92,437	294,163
LP gases .... do....	210,435	380,887	226,624	428,819
Perlite .... short tons..	--	--	2,391	24
Petroleum (crude) .... thousand 42-gallon barrels..	1,222,926	4,261,775	1,301,685	4,536,077
Pumice .... thousand short tons..	4	4	W	W
Salt .... do....	9,217	40,838	9,744	36,544
Sand and gravel .... do....	32,788	51,814	35,151	56,328
Stone .... do....	41,168	[2]62,144	49,314	[2]66,573
Sulfur (Frasch process) .... thousand long tons..	[r]3,092	W	3,847	W
Talc .... short tons..	193,830	1,024	221,022	1,262
Value of items that cannot be disclosed:				
Native asphalt, coal (lignite), fluorspar (1972), graphite, iron ore, magnesium chloride (for metal), magnesium compounds (except for metal), mercury, sodium sulfate, stone (dimension), uranium (recoverable content U_3O_8), and values indicated by the symbol W	XX	[r]132,210	XX	143,427
Total	XX	[r]6,808,283	XX	7,211,551
Total 1967 constant dollar	XX	5,789,083	XX	[p]5,999,289

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes value of dimension stone; included with "Value of items that cannot be disclosed."

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[1] Petroleum engineer, Division of Fossil Fuels—Mineral Supply.

[2] Geologist, Bureau of Economic Geology, The University of Texas at Austin, Austin, Tex.

Table 2.—Value of mineral production in Texas, by county[1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Anderson	$41,959	$47,132	Petroleum, natural gas, natural gas liquids.
Andrews	257,666	246,718	Petroleum, natural gas liquids, natural gas.
Angelina	W	500	Clays, natural gas, petroleum.
Aransas	15,083	18,236	Natural gas, petroleum, natural gas liquids.
Archer	17,955	16,496	Petroleum, natural gas.
Armstrong	761	--	
Atascosa	23,305	21,954	Petroleum, natural gas, natural gas liquids.
Austin	9,430	11,009	Petroleum, natural gas.
Bailey	--	W	Stone.
Bastrop	884	983	Clays, petroleum, natural gas.
Baylor	8,270	2,687	Petroleum, natural gas.
Bee	17,940	17,571	Natural gas, petroleum, natural gas liquids, stone.
Bell	W	975	Sand and gravel, stone, natural gas.
Bexar	32,157	33,347	Cement, stone, natural gas liquids, petroleum, sand and gravel, lime, clays, natural gas.
Blanco	W	1	Sand and gravel.
Borden	31,034	33,572	Petroleum, natural gas, sand and gravel, stone.
Bosque	727	1,956	Lime, stone.
Bowie	377	363	Sand and gravel, petroleum, natural gas.
Brazoria	244,189	243,048	Petroleum, natural gas, magnesium chloride, natural gas liquids, salt, magnesium compounds, lime.
Brazos	W	2,542	Natural gas, sand and gravel, petroleum.
Brewster	W	W	Flourspar, clays.
Briscoe	144	--	
Brooks	62,960	56,358	Natural gas, petroleum, natural gas liquids.
Brown	W	2,477	Stone, petroleum, natural gas, clays.
Burleson	267	402	Petroleum, natural gas.
Burnet	5,418	W	Stone, graphite.
Caldwell	9,918	9,710	Petroleum, natural gas.
Calhoun	26,175	23,759	Natural gas, petroleum, stone, natural gas liquids, lime.
Callahan	4,888	3,560	Petroleum, natural gas, natural gas liquids, stone.
Cameron	8,008	2,699	Natural gas, petroleum.
Camp	3,254	2,987	Petroleum, natural gas.
Carson	35,334	34,819	Natural gas, natural gas liquids, petroleum.
Cass	20,822	21,292	Natural gas liquids, petroleum, natural gas, iron ore.
Chambers	117,835	125,882	Petroleum, natural gas, natural gas liquids, salt, clays.
Cherokee	11,144	12,525	Petroleum, natural gas liquids, clays, natural gas.
Childress	773	246	Petroleum, natural gas.
Clay	12,174	10,621	Petroleum, natural gas, stone.
Cochran	37,182	40,118	Petroleum, natural gas, natural gas liquids.
Coke	25,123	23,978	Petroleum, natural gas liquids, natural gas.
Coleman	3,712	3,244	Petroleum, natural gas, clays.
Collin	--	W	Stone.
Collingsworth	1,565	1,516	Natural gas, petroleum.
Colorado	53,002	52,196	Natural gas liquids, natural gas, sand and gravel, petroleum.
Comal	W	W	Stone, lime.
Comanche	178	339	Stone, natural gas, clays, petroleum.
Concho	1,648	1,649	Petroleum, natural gas, natural gas liquids.
Cooke	33,427	36,556	Petroleum, natural gas liquids, natural gas, stone.
Coryell	W	234	Stone.
Cottle	71	56	Petroleum, natural gas.
Crane	206,119	202,188	Petroleum, natural gas, natural gas liquids.
Crockett	53,411	53,964	Do.
Crosby	1,053	1,463	Sand and gravel, petroleum, natural gas.
Culberson	W	W	Sulfur, petroleum, talc, natural gas.
Dallam	29	W	Natural gas.
Dallas	15,261	16,102	Cement, sand and gravel, stone, clays.
Dawson	37,602	41,759	Petroleum, natural gas, natural gas liquids, stone.
Deaf Smith	--	W	Lime.
Denton	1,992	1,997	Sand and gravel, clays, petroleum, stone, natural gas.
De Witt	13,298	13,127	Natural gas, petroleum, natural gas liquids, sand and gravel.
Dickens	1,058	862	Petroleum, natural gas.
Dimmit	21,853	28,206	Petroleum, natural gas liquids, natural gas.
Donley	51	W	Natural gas.
Duval	38,819	36,858	Petroleum, natural gas, natural gas liquids, salt.
Eastland	3,507	2,758	Petroleum, clays, natural gas, natural gas liquids.
Ector	335,673	344,228	Petroleum, natural gas liquids, natural gas, cement, stone.
Edwards	39	95	Petroleum, natural gas.
Ellis	W	41,202	Cement, stone, clays, petroleum, natural gas.
El Paso	W	7,693	Cement, stone, sand and gravel.
Erath	989	780	Natural gas, natural gas liquids, petroleum.
Falls	98	377	Natural gas, petroleum.
Fayette	1,631	1,745	Clays, petroleum, natural gas.
Fisher	27,754	36,989	Petroleum, natural gas liquids, natural gas, gypsum, clays, stone.
Floyd	7	8	Petroleum, natural gas.
Foard	1,172	1,068	Do.
Fort Bend	69,291	79,779	Petroleum, sulfur, natural gas, salt, natural gas liquids, clays.
Franklin	19,344	18,191	Petroleum, natural gas liquids, natural gas.

See footnotes at end of table.

Table 2.—Value of mineral production in Texas, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Freestone	$7,946	$7,541	Coal, natural gas, petroleum, stone, clays.
Frio	4,569	4,843	Petroleum, natural gas, natural gas liquids.
Gaines	165,797	195,600	Petroleum, natural gas, natural gas liquids, sodium sulfate, stone.
Galveston	45,928	50,343	Petroleum, natural gas, natural gas liquids, clays.
Garza	15,248	17,877	Petroleum, natural gas.
Gillespie	W	W	Gypsum, stone, sand and gravel.
Glasscock	9,200	8,447	Petroleum, natural gas.
Goliad	10,026	9,995	Natural gas, petroleum.
Gonzales	1,624	1,229	Natural gas, petroleum, clays.
Gray	40,203	37,772	Petroleum, natural gas, natural gas liquids, sand and gravel.
Grayson	35,231	30,757	Petroleum, natural gas, natural gas liquids, sand and gravel, stone.
Gregg	185,641	203,294	Petroleum, natural gas liquids, natural gas.
Grimes	92	52	Petroleum, natural gas.
Guadalupe	9,627	9,777	Petroleum, sand and gravel, clays, natural gas.
Hale	17,788	17,043	Petroleum, natural gas, natural gas liquids.
Hall	15	--	
Hamilton	78	215	Natural gas, petroleum.
Hansford	21,883	23,052	Natural gas, helium, petroleum.
Hardeman	5,211	4,897	Petroleum, gypsum, natural gas liquids, natural gas.
Hardin	28,579	26,683	Petroleum, natural gas, natural gas liquids, sand and gravel.
Harris	171,777	184,074	Petroleum, cement, natural gas liquids, natural gas, salt, sand and gravel, lime, clays.
Harrison	18,936	15,815	Petroleum, natural gas, natural gas liquids, coal, clays.
Hartley	2,254	2,472	Natural gas, sand and gravel.
Haskell	10,243	9,960	Petroleum, natural gas, stone.
Hemphill	26,748	31,403	Natural gas, petroleum, sand and gravel.
Henderson	44,908	52,076	Petroleum, natural gas, natural gas liquids, clays, sand and gravel.
Hidalgo	36,298	35,386	Natural gas, natural gas liquids, petroleum, stone, sand and gravel.
Hill	W	W	Lime.
Hockley	149,416	163,411	Petroleum, natural gas liquids, natural gas.
Hood	25	W	Natural gas.
Hopkins	11,731	11,289	Petroleum, natural gas liquids, natural gas.
Houston	8,059	7,240	Petroleum, natural gas, natural gas liquids.
Howard	61,457	62,528	Petroleum, natural gas liquids, natural gas, sand and gravel, stone.
Hudspeth	1,892	1,392	Talc, stone, gypsum.
Hunt	182	182	Natural gas, petroleum.
Hutchinson	74,275	73,045	Natural gas liquids, petroleum, natural gas, sand and gravel, stone, salt.
Irion	5,567	6,517	Petroleum, natural gas liquids, natural gas.
Jack	15,916	18,690	Petroleum, natural gas, stone, natural gas liquids.
Jackson	104,894	102,096	Petroleum, natural gas, natural gas liquids.
Jasper	2,327	1,443	Petroleum, natural gas, lime.
Jefferson	r 69,351	65,169	Natural gas, petroleum, sulfur, natural gas liquids, salt, clays, sand and gravel.
Jim Hogg	12,681	11,047	Natural gas, petroleum, natural gas liquids, stone.
Jim Wells	85,850	83,076	Natural gas, petroleum, natural gas liquids.
Johnson	W	4,557	Lime, stone, sand and gravel.
Jones	9,020	8,806	Petroleum, sand and gravel, natural gas, stone.
Karnes	25,257	27,943	Petroleum, uranium, natural gas, natural gas liquids.
Kaufman	2,828	2,690	Petroleum, stone, natural gas.
Kenedy	27,507	23,992	Natural gas, natural gas liquids, petroleum.
Kent	56,689	69,598	Petroleum, natural gas, sand and gravel.
Kerr	W	W	Stone, sand and gravel.
Kimble	134	314	Natural gas, sand and gravel, petroleum.
King	6,032	6,392	Petroleum, natural gas.
Kinney	3	--	
Kleberg	198,456	195,483	Natural gas, petroleum, natural gas liquids, stone.
Knox	4,463	3,453	Petroleum, natural gas.
Lamb	1,035	747	Petroleum, stone, natural gas.
Lampasas	3	54	Sand and gravel.
La Salle	2,582	2,927	Petroleum, natural gas.
Lavaca	8,202	8,564	Natural gas, natural gas liquids, petroleum.
Lee	188	85	Petroleum, natural gas.
Leon	3,248	3,053	Do.
Liberty	r 36,971	34,678	Petroleum, sulfur, natural gas, natural gas liquids.
Limestone	5,092	4,951	Sand and gravel, clays, natural gas, petroleum.
Lipscomb	13,610	13,123	Natural gas, petroleum.
Live Oak	22,217	19,329	Natural gas, petroleum, uranium, natural gas liquids.
Llano	W	703	Stone, sand and gravel.
Loving	6,070	5,504	Petroleum, natural gas.
Lubbock	2,759	2,901	Petroleum, stone, natural gas.
Lynn	1,124	992	Petroleum, natural gas.
McCulloch	W	1,999	Stone, sand and gravel, natural gas.
McLennan	9,253	11,958	Cement, sand and gravel, natural gas liquids, stone, clays, natural gas.

See footnotes at end of table.

Table 2.—Value of mineral production in Texas, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
McMullen	$11,276	$10,978	Natural gas, petroleum, stone.
Madison	2,986	2,719	Natural gas, petroleum.
Marion	7,170	5,578	Petroleum, natural gas, natural gas liquids, clays.
Martin	39,655	44,415	Petroleum, natural gas.
Mason	2	--	
Matagorda	r 65,281	55,851	Natural gas, petroleum, natural gas liquids, stone, salt.
Maverick	4,371	4,892	Petroleum, natural gas, natural gas liquids, sand and gravel.
Medina	718	616	Petroleum, clays, natural gas.
Menard	960	919	Petroleum, natural gas.
Midland	66,609	69,842	Petroleum, natural gas liquids, natural gas, stone.
Milam	W	W	Coal, petroleum, natural gas.
Mills	10	--	
Mitchell	16,678	17,517	Petroleum, stone, natural gas, sand and gravel.
Montague	15,277	18,885	Petroleum, natural gas, natural gas liquids, sand and gravel.
Montgomery	59,892	78,017	Petroleum, natural gas liquids, natural gas.
Moore	70,581	68,618	Natural gas, natural gas liquids, helium, petroleum.
Morris	W	W	Iron ore.
Motley	1,921	1,828	Petroleum, natural gas.
Nacogdoches	5,029	4,631	Natural gas, iron ore, petroleum, clays.
Navarro	7,281	10,518	Petroleum, natural gas, clays, stone.
Newton	4,856	5,078	Petroleum, natural gas.
Nolan	34,888	36,277	Petroleum, cement, natural gas liquids, natural gas, gypsum, stone, sand and gravel.
Nueces	95,609	93,262	Natural gas, petroleum, natural gas liquids, cement, lime, stone.
Ochiltree	86,908	84,197	Petroleum, natural gas, natural gas liquids.
Oldham	1,495	1,818	Sand and gravel, petroleum, natural gas.
Orange	11,409	11,516	Cement, petroleum, natural gas, clays.
Palo Pinto	5,588	5,883	Natural gas liquids, natural gas, petroleum, clays, sand and gravel.
Panola	29,616	27,396	Natural gas, natural gas liquids, petroleum.
Parker	5,472	5,097	Natural gas liquids, natural gas, stone, clays, sand and gravel, petroleum.
Pecos	207,464	236,893	Natural gas, petroleum, natural gas liquids, sulfur, stone, sand and gravel.
Polk	6,344	6,226	Petroleum, natural gas.
Potter	20,628	24,321	Natural gas, cement, natural gas liquids, stone, sand and gravel, clays, petroleum.
Presidio	W	W	Perlite, mercury.
Rains	1,018	W	Natural gas, petroleum.
Randall	472	689	Stone.
Reagan	42,558	43,583	Petroleum, natural gas liquids, natural gas.
Red River	78	67	Petroleum.
Reeves	41,908	41,894	Natural gas, petroleum, natural gas liquids, sand and gravel.
Refugio	144,878	164,798	Petroleum, natural gas, natural gas liquids.
Roberts	10,425	10,774	Natural gas, petroleum.
Robertson	51	54	Natural gas, petroleum, stone.
Runnels	7,292	6,578	Petroleum, natural gas, sand and gravel, natural gas liquids.
Rusk	87,189	88,990	Petroleum, natural gas liquids, natural gas, clays.
San Jacinto	1,280	1,212	Petroleum, natural gas.
San Patricio	39,644	36,552	Petroleum, natural gas, natural gas liquids, stone, sand and gravel, clays.
San Saba	6	--	
Schleicher	12,349	11,218	Petroleum, natural gas, natural gas liquids.
Scurry	294,878	351,967	Petroleum, natural gas liquids, natural gas, magnesium chloride, stone.
Shackelford	14,323	14,422	Petroleum, natural gas, natural gas liquids, stone.
Shelby	1,049	916	Natural gas, petroleum.
Sherman	12,424	11,714	Do.
Smith	17,468	17,399	Petroleum, natural gas, natural gas liquids, clays.
Somervell	W	W	Sand and gravel.
Starr	49,682	44,970	Petroleum, natural gas, natural gas liquids, pumice, clays.
Stephens	9,667	11,040	Petroleum, natural gas, natural gas liquids.
Sterling	6,774	5,346	Petroleum, natural gas.
Stonewall	23,061	22,197	Petroleum, natural gas liquids, natural gas, stone, sand and gravel.
Sutton	2,544	3,211	Natural gas, petroleum, natural gas liquids.
Tarrant	18,692	19,862	Cement, sand and gravel, stone, natural gas.
Taylor	12,869	13,072	Petroleum, stone, natural gas, natural gas liquids, clays.
Terrell	5,457	5,476	Natural gas, petroleum.
Terry	38,835	41,378	Petroleum, sodium sulfate, natural gas liquids, natural gas.
Throckmorton	6,748	6,558	Petroleum, natural gas.
Titus	9,556	9,578	Do.
Tom Green	7,746	8,628	Petroleum, natural gas, natural gas liquids, stone.
Travis	5,317	6,114	Lime, stone, sand and gravel, petroleum, natural gas.
Trinity	17	18	Petroleum, natural gas.
Tyler	4,466	3,906	Do.
Upshur	11,545	12,562	Petroleum, natural gas, sand and gravel.

See footnotes at end of table.

Table 2.—Value of mineral production in Texas, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Upton	$61,970	$59,665	Petroleum, natural gas, natural gas liquids.
Uvalde	7,251	9,227	Asphalt, stone, sand and gravel, natural gas.
Val Verde	518	479	Natural gas, petroleum.
Van Zandt	60,752	78,268	Petroleum, natural gas liquids, salt, natural gas, clays.
Victoria	28,784	24,727	Petroleum, natural gas, sand and gravel, natural gas liquids.
Walker	882	167	Clays, natural gas, petroleum.
Waller	88,002	89,264	Natural gas, natural gas liquids, petroleum.
Ward	98,525	108,282	Natural gas, petroleum, natural gas liquids, sand and gravel, salt.
Washington	855	704	Petroleum, natural gas.
Webb	11,249	10,840	Petroleum, natural gas, natural gas liquids, sand and gravel, clays.
Wharton	[r] 56,308	56,565	Sulfur, petroleum, natural gas, natural gas liquids, clays.
Wheeler	8,958	8,408	Petroleum, natural gas, natural gas liquids.
Wichita	28,302	27,130	Petroleum, natural gas liquids, natural gas, sand and gravel, stone.
Wilbarger	14,957	15,470	Petroleum, natural gas liquids, natural gas, stone, sand and gravel.
Willacy	14,715	12,796	Petroleum, natural gas.
Williamson	W	4,583	Stone, lime, natural gas liquids, natural gas.
Wilson	2,638	2,424	Petroleum, clays, natural gas.
Winkler	110,767	102,638	Petroleum, natural gas, natural gas liquids.
Wise	46,818	47,444	Natural gas liquids, natural gas, stone, petroleum, sand and gravel, clays.
Wood	187,859	168,898	Petroleum, natural gas liquids, natural gas, clays, sand and gravel.
Yoakum	180,762	221,788	Petroleum, natural gas liquids, natural gas, salt.
Young	12,558	11,471	Petroleum, natural gas, natural gas liquids, sand and gravel.
Zapata	8,858	4,210	Natural gas, petroleum.
Zavala	4,490	7,506	Petroleum, natural gas.
Undistributed [2]	91,480	119,981	
Total [3]	[r] 6,808,288	7,211,551	

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties were not listed because no production was reported: Bandera, Castro, Delta, Fannin, Hays, Jeff Davis, Kendall, Lamar, Parmer, Real, Rockwall, Sabine, San Augustine, and Swisher.

[2] Includes some sand and gravel, stone, petroleum, and natural gas liquids that cannot be assigned to specific counties, gem stones, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Texas business activity

	1971	1972 [p]	Change, percent
Annual average labor force and employment:			
Total labor force thousands	4,764.6	4,936.6	+3.6
Unemployment do	198.8	176.8	−11.1
Employment:			
Construction do	229.3	251.6	+9.7
Mining do	101.9	102.8	+0.9
Manufacturing do	714.1	741.1	+3.8
Transportation and public utilities do	255.6	262.7	+2.8
Wholesale and retail trade do	900.1	951.2	+5.7
Finance, insurance, and real estate do	201.6	216.8	+7.5
Services do	605.3	644.2	+6.4
Government do	684.2	711.4	+4.0
Personal income:			
Total millions	$42,582	$47,121	+10.7
Per capita do	$3,726	$4,045	+8.6
Construction activity:			
Value of authorized nonresidential construction millions	$974.5	$1,145.7	+17.6
Number of new building permits issued	125,801	127,719	+1.5
Highway construction contracts awarded millions	$412.3	[e] $360.0	−12.7
Cement shipments to and within Texas thousand short tons	6,313	6,965	+10.3
Farm marketing receipts millions	$3,935.2	$4,462.2	+13.4
Mineral production value do	$6,808.3	$7,211.6	+5.9

[e] Estimate. [p] Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Table 2.—Value of mineral produ

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County	1971	1972	
McMullen	$11,276	$10,973	Na
Madison	2,986	2,719	Na
Marion	7,170	5,578	Pe
Martin	39,655	44,415	Pe
Mason	2	--	
Matagorda	[r] 65,281	55,851	Na
Maverick	4,371	4,392	Pe
Medina	718	616	Pe
Menard	960	919	Pe
Midland	66,609	69,842	Pe
Milam	W	W	Co
Mills	10	--	
Mitchell	16,678	17,517	Pe
Montague	15,277	13,835	Pe
Montgomery	59,892	78,017	Pe
Moore	70,581	68,618	N
Morris	W	W	Ir
Motley	1,921	1,823	Pe
Nacogdoches	5,029	4,681	N
Navarro	7,231	10,513	P
Newton	4,856	5,073	P
Nolan	34,383	36,277	P
Nueces	95,609	93,262	N
Ochiltree	36,908	34,197	P
Oldham	1,495	1,818	S
Orange	11,409	11,516	C
Palo Pinto	5,533	5,883	N
Panola	29,616	27,396	N
Parker	5,472	5,097	N
Pecos	207,464	236,893	N
Polk	6,344	6,226	I
Potter	20,628	24,321	N
Presidio	W	W	I
Rains	1,013	W	N
Randall	472	689	S
Reagan	42,558	43,583	I
Red River	73	67	I
Reeves	41,908	41,394	N
Refugio	144,378	164,793	I
Roberts	10,425	10,774	N
Robertson	51	54	N
Runnels	7,292	6,578	I
Rusk	87,189	88,990	I
San Jacinto	1,280	1,212	I
San Patricio	39,644	36,552	I
San Saba	6	--	
Schleicher	12,349	11,218	I
Scurry	294,373	351,967	I
Shackelford	14,823	14,422	P
Shelby	1,049	916	N
Sherman	12,424	11,714	
Smith	17,468	17,899	P
Somervell	W	W	S
Starr	49,682	44,970	P
Stephens	9,667	11,040	P
Sterling	6,774	5,846	P
Stonewall	23,061	22,197	P
Sutton	2,544	3,211	N
Tarrant	13,692	19,862	Ce
Taylor	12,869	13,072	Pe
Terrell	5,457	5,476	Na
Terry	38,835	41,378	Pe
Throckmorton	6,748	6,558	Pe
Titus	9,556	9,578	
Tom Green	7,746	8,628	Pe
Travis	5,[illegible]	6,114	Li
Trinity	[illegible]	18	Pe
Tyler	[illegible]	[illegible],906	
Upshur	[illegible]	[illegible],562	Pe

See footnotes at en

Table 2.—Va

County
Upton
Uvalde
Val Verde
Van Zandt
Victoria
Walker
Waller
Ward
Washington
Webb
Wharton
Wheeler
Wichita
Wilbarger
Willacy
Williamson
Wilson
Winkler
Wise
Wood
Yoakum
Young
Zapata
Zavala
Undistributed
Total[3]

[r] Revised. distributed."

[1] The follo Hays, Jeff I

[2] Includes counties, ge

[3] Data m

Annual To Up Ex

il, natural gas, and natural gas liquids l the United States

oil equivalent)

from 1971 (ent)	Distribution percentage				Texas percent of United States	
United States	Texas		United States			
	1971	1972	1971	1972	1971	1972
+0.08	41.1	42.3	43.6	43.5	35.4	37.7
+.17	51.4	50.2	50.7	50.7	38.0	38.4
+3.33	7.5	7.5	5.7	5.8	49.8	50.1
+.29	100.0	100.0	100.0	100.0	37.5	38.8

ral gas or 57.6 gallons of natural gas liquids

l gas liquids reserves to production d States[1]

uivalent)

percentage					
Change from 1971		Reserve-production ratio			
Texas	United States	Texas		United States	
		1971 r	1972	1971 r	1972
6.8	−4.5	11.0	9.7	11.7	11.1
−6.3	−4.6	12.4	11.5	12.6	11.8
6.8	−7.1	9.2	8.6	9.8	9.0
6.5	−4.7	11.6	10.5	12.0	11.3

Association and American Petroleum ural gas or 57.6 gallons of natural gas

l gas, and natural gas liquids

nt)

ntage of—			
Change from previous year			
Oil	Gas	Liquids	Total
1.2	4.2	4.5	2.9
1.7	4.8	1.4	3.2
8.5	6.4	3.8	7.1
−2.2	2.3	2.3	.4
6.5	1.2	4.0	3.6

57.6 gallons of natural gas liquids.

nts. In addition to 12 fur- as had the only two chan- he United States. Channel n was 22.4 million pounds, put in Texas. Capacity of State totaled 5.08 million 44.5% of the U.S. total. rbon black yield from an ion cubic feet of natural ties. Petroleum was produced in 201 counties, natural gas in 210, nonmetallic minerals in 133 and metallic mineral ores mined in eight counties.

The varied mineral-processing industry of Texas consisted of smelters, refineries, and reduction plant facilities that produced aluminum, antimony, bromine, cadmium, copper, iron, lead, magnesium, manganese, sodium, tin-tungsten, and zinc. Precious metals also were recovered in special units associated with existing smelting facilities. Secondary metal recovery plants processed various types of scrap and other secondary material feedstocks to recover aluminum, lead, iron and steel, tin, zinc, and precious metals.

The value of mineral output in each of 18 counties was more than $100 million. In eight of these counties mineral output

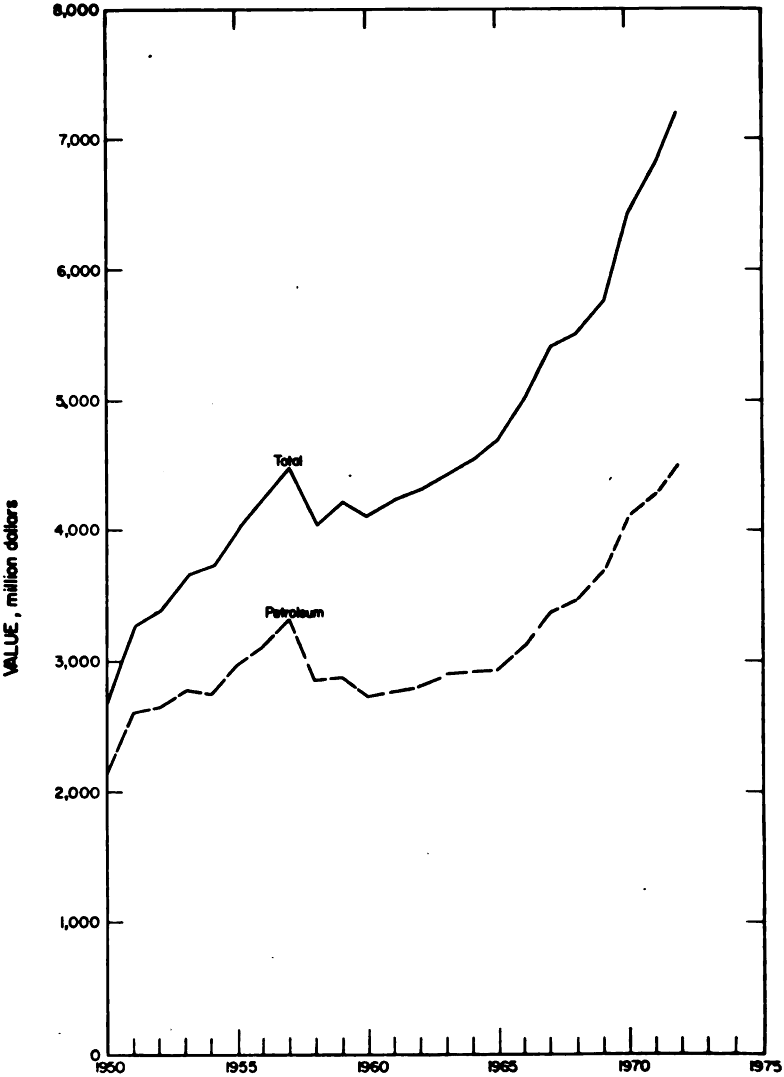

Figure 1.—Value of petroleum and total value of mineral production in Texas.

exceeded $200 million. Petroleum continued to be the principal contributor to the State's mineral production value by accounting for 62.9% of the total. Natural gas and natural gas liquids contributed 19.7% and 10.0% respectively of the State total.

Trends and Developments.—Texas received a favorable decision in the boundary dispute with Louisiana over the oil rich lands of the Sabine River. Judge Robert Van Pelt, special master appointed in the case by the U.S. Supreme Court, recognized the Texas claim to a boundary in the middle of the Sabine River, Sabine Lake, and Sabine Pass.

The Texas Railroad Commission (RRC) increased the market demand factor (MDF) for crude oil allowables to 100% in April, the first time in 24 years. An MDF of 100% was then promulgated for the ensuing months in 1972. Record high crude oil production of 3.65 million barrels per day was attained in May. By yearend reserve crude oil producing capability was virtually nonexistent. The MDF for some fields was reduced by the RRC because of gas flaring that occurred. In October, the RRC called a hearing to obtain information pertaining to the establishment of priorities for gas supply curtailments.

For the first time, American Oil Co. Amoco imported North African crude oil for use at its Texas City refinery. An official stated that the company was unable to obtain sufficient domestic crude oil feedstock to operate the refinery at capacity.

As a result of legal actions initiated by the City of El Paso and the Texas Air Control Board, American Smelting and Refining Co. (ASARCO) was ordered to control emission of heavy metal particles from its lead smelter at El Paso. In what may be a precedent setting action for the metals industry, the City of El Paso, the Texas Air Control Board, and ASARCO entered into a consent decree. The decree calls for ASARCO to make penalty payments to the City of El Paso, and the State of Texas, and to pay for detection and treatment of children in the area of ASARCO's smelter who are found to have elevated lead level concentrations in their blood.

A large secondary recovery project was started in the North Cross Unit of the Crossett field, about 50 miles south of Odessa. Planned operation includes the injection of 20 million cubic feet of carbon dixoide (CO_2) per day into the Devonian age oil productive reservoir for 10 years and then initiate a water injection program.

Continued pressures on sulfur prices because of increased supplies of recovered sulfur from "sour" oil and gas resulted in the shutdown of additional Frasch operations. Duval Corp. discontinued operations at Fort Stockton and moved the 12 boilers

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	173	246	43	341	--	9	26.43	NA
Metal	1,635	277	453	3,646	--	40	10.97	452
Nonmetal	1,982	267	530	4,358	--	139	31.90	681
Sand and gravel	1,932	259	500	4,736	--	120	25.34	758
Stone	4,311	300	1,294	11,104	2	233	21.16	2,314
Total	10,033	281	[1] 2,819	24,185	2	541	22.45	NA
1972:[2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	815	258	210	1,749	--	49	28.01	1,026
Nonmetal	1,585	278	441	3,662	--	105	28.67	846
Sand and gravel	1,480	260	385	3,565	2	88	25.24	5,537
Stone	8,840	292	1,122	9,738	3	225	23.41	3,150
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data do not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

and associated equipment to its Culberson County operation, as part of an overall plan to improve production efficiency.

Centex Cement Corp. in Corpus Christi and Capitol Aggregates, Inc. of San Antonio, jointly imported 2,100 tons of cement clinker from England and Denmark. The companies reported that the shipment was a trial to determine the economic feasibility of importing clinker.

Employment and Injuries.—Employment and injury statistics of the mineral industry as compiled by the Federal Bureau of Mines are shown in table 4.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

The value of mineral fuels increased 5.7% to $6,707 million and accounted for 93.0% of the total value of mineral output in Texas. Petroleum continued as the major mineral value contibutor by accounting for 62.9% of the States total value and 67.6% of mineral fuels value. Natural gas and natural gas liquids contributed 21.2% and 10.8%, respectively, of mineral fuels value. Asphalt, coal (lignite), and helium accounted for the remaining 0.4%.

The RRC allowed prorated wells to produce the equivalent of 345 days in 1972 compared with 265 equivalent days in 1971. The MDF was 100% for the last 8 months of the year. Although the average MDF increased from 72.5% in 1971 to 94.1% in 1972, an increase of 29.8%, crude petroleum output increased only 6.4%, indicating a decline in producing capability as allowables increased. Daily average production declined under the sustained 8-month 100% MDF in 1972.

A total of 7,666 exploratory and development wells, including 53 offshore, were drilled in Texas in 1972, according to the American Petroleum Institute (API). The number of wells drilled increased by 395, or 5.4% above that of 1971. Success ratio of exploratory wells was 18.3%, and 79.8% of development wells produced oil and/or gas. The 1,973 exploratory wells drilled resulted in 179 oil discoveries, 183 gas discoveries and 1,611 dry holes. Of the 5,693 development wells drilled, 3,784 were oil productive, 760 were gas wells, and 1,149 were dry holes.

Pipelines.—Product and natural gas pipelines accounted for the major pipeline construction in 1972. Among the projects were the following: Oasis Pipe Line Co. constructed a 333-mile, 36-inch gas pipeline from Coyanosa, near Pecos in West Texas, to New Braunfels to interconnect with the Intratex Gas Co. system in the Delaware Basin. Initial scheduled capacity of the line was 1 billion cubic feet of gas per day. Humble Pipeline Co. installed 155 miles of 8-inch products pipeline from Victoria to Mont Belvieu.

Table 5.—Texas: Production and value of petroleum, natural gas, and natural gas liquids

Year	Crude Petroleum		Natural Gas [1]	
	Thousand 42-gallon barrels	Value (thousands)	Million cubic feet	Value (thousands)
1968	1,133,380	$3,450,707	7,495,414	$1,011,881
1969	1,151,775	3,696,328	7,853,199	1,075,888
1970	1,249,697	4,104,005	8,357,716	1,203,511
1971	1,222,926	4,261,775	8,550,705	1,376,664
1972	1,301,685	4,536,077	8,657,840	1,419,886

Year	Natural gas liquids					
	Natural gasoline and cycle products		LP gases and ethane		Total	
	Thousand 42-gallon barrels	Value (thousands)	Thousand 42-gallon barrels	Value (thousands)	Thousand 42-gallon barrels	Value (thousands)
1968	97,075	$269,182	189,162	$278,068	286,237	$547,250
1969	96,628	289,042	194,599	237,411	291,227	526,453
1970	97,511	284,871	204,177	334,850	301,688	619,721
1971	96,286	299,981	210,435	380,887	306,721	680,868
1972	92,437	294,163	226,624	428,319	319,061	722,482

[1] Marketed production, gas either sold or consumed by producers including losses in transmission, amounts added to storage, and increases in gas pipelines.

Table 6.—Texas: Comparison of crude oil, natural gas, and natural gas liquids production in Texas and the United States

(Million barrels of crude oil equivalent)

Commodity	Production as oil equivalent [1]				Change from 1971 (percent)		Distribution percentage				Texas percent of United States	
	Texas		United States		Texas	United States	Texas		United States			
	1971	1972	1971	1972			1971	1972	1971	1972	1971	1972
Crude oil	1,223	1,302	3,454	3,455	+6.5	+0.03	41.1	42.3	43.6	43.5	35.4	37.7
Natural gas (marketed)	1,527	1,546	4,017	4,024	+1.2	+.17	51.4	50.2	50.7	50.7	38.0	38.4
Natural gas liquids	224	233	450	465	+4.0	+3.33	7.5	7.5	5.7	5.8	49.8	50.1
Total equivalent	2,974	3,081	7,921	7,944	+3.6	+.29	100.0	100.0	100.0	100.0	37.5	38.8

[1] One barrel of crude oil equivalent to 5,600 cubic feet of natural gas or 57.6 gallons of natural gas liquids

Table 7.—Texas: Crude oil, natural gas, and natural gas liquids reserves to production ratio in Texas and the United States [1]

(Million barrels of crude oil equivalent)

Commodity	Reserve				Reserve percentage				Reserve-production ratio			
					Texas of United States		Change from 1971					
	Texas		United States				Texas	United States	Texas		United States	
	1971	1972	1971	1972	1971	1972			1971 [r]	1972	1971 [r]	1972
Crude oil	13,024	12,144	38,063	36,339	34.2	33.4	−6.8	−4.5	11.0	9.7	11.7	11.1
Natural gas	18,120	16,972	49,787	47,515	36.4	35.7	−6.3	−4.6	12.4	11.5	12.6	11.8
Natural gas liquids	2,261	2,108	5,326	4,949	42.5	42.6	−6.8	−7.1	9.2	8.6	9.8	9.0
Total oil equivalent	33,405	31,224	93,176	88,803	35.9	35.2	−6.5	−4.7	11.6	10.5	12.0	11.3

[r] Revised.

[1] Estimated proved reserves and production from American Gas Association and American Petroleum Institute. One barrel of crude oil equivalent to 5,600 cubic feet of natural gas or 57.6 gallons of natural gas liquids.

Table 8.—Texas: Production trends of crude oil, natural gas, and natural gas liquids

(Million barrels of crude oil equivalent)

Year	Production [1]				Percentage of—						
					Annual total			Change from previous year			
	Oil	Gas [2]	Liquids	Total	Oil	Gas	Liquids	Oil	Gas	Liquids	Total
1968	1,133	1,338	208	2,679	42.3	49.9	7.8	1.2	4.2	4.5	2.9
1969	1,152	1,402	211	2,765	41.7	50.7	7.6	1.7	4.8	1.4	3.2
1970	1,250	1,492	219	2,961	42.2	50.4	7.4	8.5	6.4	3.8	7.1
1971	1,223	1,527	224	2,974	41.1	51.3	7.5	−2.2	2.3	2.3	.4
1972	1,302	1,546	233	3,081	42.3	50.2	7.6	6.5	1.2	4.0	3.6

[1] One barrel of crude oil equivalent to 5,600 cubic feet of natural gas or 57.6 gallons of natural gas liquids.

[2] Marketed gas.

Asphalt (Native).—Two companies quarried native asphalt rock in Uvalde County. Output increased significantly, and Texas continued to lead the Nation in output of this commodity. Unit value increased 8.7%.

Carbon Black.—Output increased 7.5% to 1,426 million pounds and was 44.5% of total U.S. production. This State again was the leading producer and had 14 of the Nation's 34 plants. In addition to 12 furnace plants, Texas had the only two channel plants in the United States. Channel plant production was 22.4 million pounds, 1.6% of the output in Texas. Capacity of plants in the State totaled 5.08 million pounds per day, 44.5% of the U.S. total. Statewide, the carbon black yield from an input of 24.7 billion cubic feet of natural

Table 9.—Texas: Estimated proved reserves of natural gas, natural gas liquids, and crude oil, by railroad district

Railroad district	Proved reserves Dec. 31, 1971	Reserves added 1972: Extensions and revisions	Reserves added 1972: New fields and new pools	Proved reserves Dec. 31, 1972	Change from Dec. 31, 1971
NATURAL GAS (MILLION CUBIC FEET)					
1	1,843,711	−118,234	19,379	1,620,405	−223,306
2	9,811,922	34,206	185,061	9,496,136	−315,786
3	22,115,227	−303,258	422,738	20,696,874	−1,418,353
4	27,073,438	−1,429,100	330,518	24,334,110	−2,739,328
5	1,260,652	19,049	23,780	1,171,395	−89,257
6	5,736,503	249,234	58,410	5,710,441	−26,062
7B	627,582	118,877	2,745	663,560	35,978
7C	3,074,154	−256,664	16,344	2,581,980	−492,174
8	15,887,502	1,436,056	137,166	15,481,337	−406,165
8A	2,533,463	74,887	420	2,366,951	−166,512
9	1,683,171	34,873	5,652	1,559,594	−123,577
10	9,824,783	645,378	84,736	9,359,260	−465,523
Total	101,472,108	505,304	1,286,949	95,042,043	−6,430,065
NATURAL GAS LIQUIDS (THOUSAND BARRELS)					
1	24,832	−4,973	122	16,742	−8,090
2	130,974	305	3,075	122,029	−8,945
3	628,599	−9,465	8,947	570,324	−58,275
4	526,108	−45,924	5,931	424,019	−102,089
5	78,093	−628	2,424	73,358	−4,735
6	402,660	7,343	654	384,345	−18,315
7B	45,692	15,511	220	52,921	7,229
7C	158,082	−22,892	347	118,506	−39,576
8	476,654	58,234	2,197	475,338	−1,316
8A	261,322	27,068	--	258,147	−3,175
9	67,422	10,395	210	68,280	858
10	300,179	65,401	2,966	327,574	27,395
Total	3,100,617	100,375	27,093	2,891,583	−209,034
CRUDE OIL (THOUSAND BARRELS)					
1	157,078	12,601	1,329	147,324	−9,754
2	785,638	−72,800	3,038	636,768	−148,870
3	1,638,611	66,268	4,725	1,536,426	−102,185
4	415,664	−17,365	4,159	343,752	−71,912
5	118,305	801	85	98,963	−19,342
6	2,359,624	13,714	1,644	2,208,438	−151,186
7B	209,473	61,456	2,010	235,962	26,489
7C	251,304	21,839	1,043	239,270	−12,034
8	3,528,991	157,041	3,769	3,402,358	−126,633
8A	3,002,588	90,850	5,612	2,793,503	−209,085
9	356,007	14,946	2,084	324,018	−31,989
10	200,246	−503	319	177,275	−22,971
Total	13,023,529	348,848	29,817	12,144,057	−879,472

Source: American Gas Association, American Petroleum Institute.

gas feedstock was 43.2 million pounds, an average yield of 1,749 pounds per thousand cubic feet. From liquid hydrocarbon feedstocks of 277.6 million gallons the yield of carbon black was 1,382.7 million pounds an average of 4.981 pounds per gallon. The value of carbon black production in Texas totaled $118 million, an average value of 8.27 cents per pound.

J. M. Huber Corp. increased thermal carbon black capacity to 50 million pounds per year at its Borger plant. Natural gas is utilized as feedstock at this plant.

Sid Richardson Carbon & Gasoline Co. added a unit to its Big Spring operation that increased reinforced carbon black capacity by 35 million pounds per year. Total plant capacity was raised to 120 million pounds per year.

Coal (Lignite).—Output in 1972 was 4 million tons, a significant increase over that of 1971. Atlas Chemical Industries, Inc. continued to mine lignite in Harrison County for use in producing activated carbon. Industrial Generating Co. mined lignite in Milam and Freestone Counties. The company is restoring strip mined areas to pasture and timber lands.

Helium.—Output and value of crude helium in Texas declined 15% to 1,026 million cubic feet and $12.3 million. Texas provided 29.6% of the Nation's crude helium output. During 1972, high-purity helium was not produced in the State. Phillips Petroleum Co. operated two plants, one each in Moore and Hansford Counties, and the Federal Bureau of Mines operated a plant at Exell in Moore County.

Because of technical problems, the extensive modernization of the Bureau of Mines Exell plant was not completed as scheduled. The modernization program was initiated to consolidate operations, improve efficiency, and facilitate underground helium storage.

Natural Gas.—Texas led the Nation in volume of natural gas marketed, supplying 38.4% of the national total. The increase to 8,658 billion cubic feet in Texas was 1.25% as compared with a 0.17% increase for the Nation. Average unit value in Texas increased 1.86% to 16.4 cents per thousand cubic feet and U.S. value increased 2.20% to 18.6 cents per thousand cubic feet.

According to the RRC, total natural gas production was 9,602 billion cubic feet, an increase of 0.33% over that of 1971. Gas produced from gas wells totaled 7,450 billion cubic feet, an increase of 1.1%. Casinghead gas production declined 2.4% to 2,152 billion cubic feet. At yearend 1972 there were 35,231 gas wells, 92 more than in 1971; however, the number of gasfields increased from 9,333 in 1971 to 9,406. Natural gas was obtained from 210 of the State's 254 counties. Each of 13 counties produced more than 200 billion cubic feet of gas, and the leading five counties accounted for 27.3% of the State's production. Leading counties and their production in billion cubic feet were Pecos, 920; Kleberg, 615; Waller, 424; Ward, 363; and Brazoria, 300.

According to the American Gas Association (AGA) proved natural gas reserves at yearend 1972 in Texas totaled 95,042 billion cubic feet, a decline of 6.3% during the year. The reserve in Texas was 35.7% of the U.S. total. During 1972, the natural gas reserves added in Texas from the discovery of new fields were 461 billion cubic feet, and reserves added from the discovery of new reservoirs in old fields totaled 826 billion cubic feet.

Exploratory efforts to locate and augment reserves continued to be of prime importance. Among the new gas discoveries indicated to be significant were Pikes East field in Pecos County and the Howe Devonian field in Ward County. These two discoveries continued to add to known reserves in the Delaware Basin. In the Panhandle of Texas, Wheeler County, the Allison and Mills Ranch Hunton fields were discovered. These deep fields, 18,105 and 21,123 feet below the surface respectively, are in the Anadarko Basin. In South Texas, field discoveries that produced from the Wilcox strata included McCaskill in Karnes County, North Brelum in Duval County, and Comitas in Zapata County. Vicksburg formation production was discovered at the Citrus and North Jeffress fields in Hidalgo County. In East Texas, the Tennessee Colony East field in Anderson County and Scoober Creek field in Rusk County were productive from the Rodessa formation. In the Texas Upper Gulf Coast area, Wilcox production was obtained in Colorado County at the Glidden and Rabel fields and also at the South Dobbin field in Montgomery County. Frio formation production was found at the North Point Bolivar field in Galveston County and the Tidehaven Deep field in Matagorda County.

Natural Gas Liquids.—Output totaled 319 million barrels, 4.0% higher than that of 1971. Texas accounted for 50% of the Nation's production and value of this commodity. Major components of natural gas liquids production in Texas were propane and butanes, 53.2%; natural gasoline and isopentane, 24.0%; ethane, 17.8%; plant condensate, 4.5%; and all other products, 0.5%.

According to the annual Oil and Gas Journal Survey,[3] there were 369 natural gas processing plants in Texas at yearend 1972 compared with 374 plants at yearend 1971. Installed plant capacity was 28.79 billion cubic feet per day, a decrease of 210 million cubic feet per day during the year.

The AGA estimated that proved natural gas liquid reserves in Texas at yearend 1972 totaled 2,892 million barrels, 42.6% of the U.S. total. During the year reserves in Texas declined 209 million barrels, a 6.7% loss. Additions to reserves from new field discoveries in Texas totaled 9.8 million barrels, and additions from the new reservoir discoveries in old fields totaled 17.3 million barrels.

Construction of new gas processing and treating plants and expansion of existing facilities continued during the year. Among the projects were:

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[3] Cantrell, Ailleen. 1973 Survey of Gas-Processing Plants. Oil and Gas. J., v. 71, No. 28, July 9, 1973, p. 98.

Adobe Oil Co. increased capacity of its Sale Ranch plant in Martin County to 18 million cubic feet per day. This plant uses the refrigeration process.

Cities Service Oil Co. started operations at a new gas processing plant at Chico, Wise County. The plant was designed to recover 6,300 barrels of natural gas liquids from the processing of 70 million cubic feet per day of gas. The plant replaced two older installations that are now operated as compressor stations to deliver gas to the new plant.

Coastal States Gas Producing Co. completed a 15-million-cubic-foot-per-day gas processing plant at Claytonville.

HNG Petrochemicals, Inc. completed a 40-million-cubic-foot-per-day gas processing plant near Sonora in Sutton County. Recovered liquids are sold to Phillips Petroleum Co. for further processing at its Sweeny refinery.

Hunt Oil Co. started construction to more than double the size and capacity of its gas processing plant in the Fairway field, Henderson County. Upon completion of construction, capacity will be 108 million cubic feet per day. The refrigeration-absorption process is used at this plant.

Oasis Pipeline Co. increased treating capacity of its Mi Vida plant in Ward County to 425 million cubic feet per day and that of its Gomez plant in Pecos County to 420 million cubic feet per day.

Perry Gas Processors, Inc. increased capacity of its Pyote plant in Ward County by 100 million cubic feet per day to 225 million cubic feet daily. It is believed that this plant is the first domestic, grass-roots, high-pressure plant to use the diethanolamine process. The company also completed its West Gomez high-pressure gas treating plant near Ft. Stockton. The iron-sponge process that uses iron oxide to react with sulfides in the gas to remove hydrogen sulfide is used in the plant. Designed plant capacity was 120 million cubic feet of gas per day.

Shell Oil Co. increased gas processing capacity of its McCamey plant by 35 million cubic feet per day. The company also expanded its Notrees plant.

Texaco, Inc. completed a new 25-million-cubic-foot-per-day plant at Ozona to process gas produced in the Ozona, Davidson Ranch, and Depaul fields. Inlet gas is refrigerated to recover natural gas liquids for pipeline sales.

Petroleum.—Crude petroleum production totaled 1.3 billion barrels, an increase of 6.4% over 1971 production and an alltime record high. Wellhead price was unchanged at $3.48 per barrel. Value of crude petroleum production, $4.5 billion, was a record high and was 38.7% of the national total.

Crude oil production was reported from 201 counties. Leading counties in order of output were Scurry, Ector, Andrews, Yoakum, Gregg, and Gaines. Ouput from these six counties accounted for 30.3% of the State total. At yearend there were 167,233 productive crude oil wells, a decrease of 5,463 wells during the year. Average crude oil production per well per day was 21.3 barrels.

In South Texas (RRC districts 1, 2, and 4), drilling activity increased 7% to 1,777 wells. Exploratory drilling decreased 5% to 516 wells, but development drilling increased 13% to 1,261 wells. Geophysical activity declined 5% to 518 crew-weeks.

Exploratory and development drilling activity continued in the Paleozoic trend in Edwards County; the Jurassic Smackover trend in Atascosa, Maverick, and Webb Counties; the Cretaceous trend in Caldwell, Guadalupe, Dimmit, Zavala, and Karnes Counties; the Eocene trend in Karnes, Duval, Zapata, McMullen, and Live Oak Counties; and the Oligocene-Miocene trend in Hidalgo, Brooks, Nueces, and Refugio Counties and the Gulf of Mexico.

Overall drilling activity in the Upper Gulf Coast of Texas (RRC district 3) declined slightly. Exploratory drilling increased 16.7% to 335 wells, but proved field well drilling declined 7.8% to 487 wells. Geophysical seismograph activity declined slightly to 237 crew-weeks of which 47 crew-weeks were in the offshore area. Principal exploratory targets were formations in the Oligocene and Eocene.

Significant Oligocene discoveries included the North Bolivar Point field in State Tract 342, Galveston County by Houston Oil and Mineral Corp. and the Tidehaven Deep field, Matagorda County, discovered by Coastal States Gas Producing Co.

Table 10.—Texas: Oil and gas well drilling completions, by county

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Anderson	20	1	3	--	1	10	35	126,798
Andrews	86	--	4	2	--	8	100	619,517
Angelina	--	--	--	--	--	1	1	620
Aransas	1	3	3	--	--	5	12	100,029
Archer	66	--	31	2	--	15	114	241,841
Atascosa	11	2	4	--	--	12	29	146,776
Austin	3	--	--	--	1	11	15	80,451
Bandera	--	--	--	--	--	1	1	12,492
Bastrop	1	--	--	--	--	1	2	11,051
Baylor	--	--	--	--	--	6	6	26,897
Bee	6	7	22	--	--	15	50	247,200
Bexar	28	--	--	--	--	--	28	19,917
Borden	8	--	2	1	--	5	16	120,855
Bowie	--	--	1	--	--	5	6	49,409
Brazoria	28	4	18	--	3	15	68	487,695
Brazos	--	2	5	--	1	--	8	26,060
Brewster	--	--	--	--	--	1	1	20,688
Brooks	11	11	5	--	--	8	35	251,517
Brown	20	8	17	--	--	4	49	85,888
Burleson	8	--	8	--	--	2	18	45,781
Cladwell	149	--	4	--	--	2	155	362,848
Calhoun	8	1	2	--	--	7	18	101,548
Callahan	44	1	58	2	--	10	115	128,587
Cameron	--	4	--	--	--	4	8	55,147
Camp	2	1	--	--	--	1	4	38,228
Carson	15	--	--	--	--	--	15	48,061
Cass	3	--	--	--	1	8	12	128,178
Castro	--	--	--	--	--	1	1	6,000
Chambers	14	--	6	3	4	12	39	334,238
Cherokee	1	1	--	--	--	10	12	77,970
Clay	19	--	10	11	--	26	66	284,644
Cochran	38	1	5	--	--	1	45	227,901
Coke	3	--	1	--	--	6	10	58,088
Coleman	15	7	14	4	1	17	58	140,928
Colorado	--	5	15	2	17	31	70	585,548
Comanche	--	--	--	1	--	--	1	8,232
Concho	1	--	1	1	--	9	12	81,977
Cooke	28	--	19	3	--	9	59	191,258
Cottle	--	--	--	--	--	5	5	21,088
Crane	144	20	6	13	1	6	190	684,595
Crockett	25	18	10	2	1	13	69	896,310
Crosby	--	--	--	--	--	2	2	7,056
Culberson	--	--	--	--	--	2	2	6,948
Dallas	--	--	--	--	--	1	1	2,205
Dawson	45	--	4	4	--	2	55	488,228
Delta	--	--	--	--	--	1	1	7,300
Denton	--	--	--	--	2	2	4	29,205
De Witt	6	17	10	--	1	12	46	389,438
Dickens	--	--	--	--	--	4	4	18,067
Dimmit	67	4	8	8	3	10	100	452,246
Donley	--	--	--	--	--	1	1	3,817
Duval	25	17	17	--	6	19	84	314,612
Eastland	5	5	6	--	1	7	24	68,884
Ector	167	1	12	1	--	3	184	992,609
Edwards	--	--	1	--	1	3	5	25,678
El Paso	--	--	--	--	--	1	1	17,708
Erath	--	1	3	--	--	1	5	14,628
Falls	1	1	--	--	1	1	4	23,168
Fayette	--	--	--	--	--	3	3	30,432
Fisher	10	--	8	1	2	8	29	140,581
Foard	3	--	1	1	--	5	10	48,648
Fort Bend	20	1	8	--	--	9	38	169,104
Franklin	2	1	1	--	--	2	6	54,728
Freestone	1	--	2	--	1	9	13	95,648
Frio	2	--	1	--	--	12	15	70,014
Gaines	62	--	8	4	--	13	87	605,236
Galveston	7	1	4	3	3	9	27	257,302
Garza	30	--	2	2	--	10	44	283,456
Glasscock	10	--	--	--	--	4	14	66,494
Goliad	4	10	12	--	--	9	35	208,679
Gonzales	1	--	1	--	--	7	9	24,168
Gray	19	1	5	--	--	1	26	88,518
Grayson	6	--	--	--	--	3	9	44,560
Gregg	2	2	--	--	--	1	5	20,157
Grimes	--	--	1	--	1	2	4	31,570
Guadalupe	122	--	3	--	--	1	126	322,307

See footnotes at end of table.

Table 10.—Texas: Oil and gas well drilling completions, by county—Continued

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Hale	6	--	--	--	--	2	8	18,456
Hall	--	--	--	--	--	2	2	6,700
Hamilton	--	--	--	--	--	2	2	8,872
Hansford	1	6	4	--	2	5	18	125,398
Hardeman	--	--	--	--	--	2	2	16,302
Hardin	48	1	8	2	2	23	84	403,734
Harris	39	2	6	--	1	7	55	323,420
Harrison	7	2	5	--	--	4	18	99,237
Hartley	--	1	--	--	--	2	3	15,823
Haskell	4	--	2	4	--	22	32	145,001
Hemphill	4	42	8	1	4	5	64	780,463
Henderson	4	1	1	--	1	4	11	102,639
Hidalgo	2	17	7	--	3	16	45	458,075
Hockley	160	1	1	1	--	8	171	878,682
Hood	--	--	--	--	--	3	3	14,645
Hopkins	--	--	1	--	--	8	9	72,516
Houston	--	5	2	--	--	2	9	94,239
Howard	61	--	19	5	--	14	99	426,504
Hudspeth	--	--	--	--	--	1	1	1,760
Hutchinson	11	5	2	1	--	1	20	79,489
Irion	55	--	3	3	1	4	66	426,345
Jack	37	2	9	4	--	19	71	230,472
Jackson	16	9	16	--	--	15	56	358,942
Jasper	--	--	--	1	--	9	10	77,776
Jefferson	13	2	7	1	6	12	41	305,276
Jim Hogg	5	6	5	1	1	17	35	157,287
Jim Wells	10	4	2	--	1	7	24	130,181
Johnson	--	--	--	--	--	2	2	13,062
Jones	8	--	17	3	--	25	53	151,249
Karnes	1	7	5	--	--	17	30	217,100
Kaufman	--	1	--	--	--	7	8	61,728
Kenedy	--	4	3	--	--	5	12	112,585
Kent	12	--	6	1	--	9	28	162,277
Kimble	--	2	4	--	--	--	6	14,099
King	10	--	8		--	21	44	210,274
Kinney	--	--	--	--	--	1	1	2,540
Kleberg	16	11	14	1	--	13	55	416,551
Knox	6	--	6	--	--	15	27	81,448
Lamar	--	--	--	--	--	2	2	15,332
Lamb	3	--	--	--	--	2	5	26,187
La Salle	6	--	2	--	1	24	33	188,513
Lavaca	4	12	9	--	--	12	37	274,171
Lee	--	--	--	--	--	1	1	3,535
Leon	--	5	--	--	1	3	9	57,239
Liberty	39	5	15	--	--	14	73	426,087
Limestone	--	--	3	--	--	4	7	41,695
Lipscomb	4	16	3	--	1	2	26	221,081
Live Oak	6	9	17	--	1	26	59	347,336
Loving	--	1	2	--	1	--	4	50,057
Lubbock	5	--	--	--	--	2	7	27,872
Lynn	--	--	--	--	--	2	2	17,208
McCulloch	--	2	10	--	--	--	12	20,087
McMullen	4	6	8	--	2	21	41	211,559
Madison	--	--	--	1	--	3	4	39,429
Marion	15	1	1	--	--	2	19	86,254
Martin	225	--	10	2	--	9	246	2,075,815
Matagorda	3	6	3	--	8	22	42	374,659
Maverick	20	3	8	3	1	12	47	135,552
Medina	--	--	--	--	--	2	2	9,995
Menard	2	--	3	--	--	4	9	22,128
Midland	74	2	1	2	--	1	80	663,478
Milam	11	--	5	2	--	1	19	75,812
Mills	--	--	--	--	--	1	1	3,098
Mitchell	40	--	--	--	1	7	48	128,641
Montague	19	--	2	4	--	17	42	190,253
Montgomery	10	1	3	--	3	4	21	141,583
Moore	37	9	1	--	--	--	47	121,020
Morris	--	--	--	--	--	1	1	5,020
Motley	--	--	1	--	--	2	3	12,189
Nacogdoches	4	4	1	--	--	3	12	81,732
Navarro	6	1	3	--	--	9	19	71,815
Newton	5	1	4	2	2	6	20	172,183
Nolan	36	1	2	2	1	12	54	309,107
Nueces	30	23	17	2	2	16	90	613,977
Ochiltree	13	9	5	--	1	2	30	235,480
Orange	6	--	1	--	--	2	9	54,901
Palo Pinto	3	5	5	--	2	8	33	81,330

See footnotes at end of table.

Table 10.—Texas: Oil and gas well drilling completions, by county—Continued

County	Proved field wells[1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Panola	7	8	3	--	1	--	19	92,823
Parker	--	7	1	--	--	2	10	32,970
Pecos	31	36	23	3	7	23	123	1,023,974
Polk	4	3	3	1	1	3	15	110,140
Potter	6	10	2	--	--	--	18	89,449
Presidio	--	--	--	--	--	2	2	20,601
Reagan	191	--	1	--	--	4	196	985,410
Red River	--	--	1	--	--	3	4	19,419
Reeves	20	3	4	--	4	--	31	240,274
Refugio	44	17	3	--	--	12	76	446,492
Roberts	1	3	1	1	1	4	11	84,119
Robertson	--	--	--	--	--	2	2	26,478
Runnels	13	--	11	5	1	40	70	260,430
Rusk	10	4	--	1	2	5	22	181,614
Sabine	--	--	--	--	--	2	2	11,260
San Jacinto	--	--	1	--	2	4	7	68,990
San Patricio	8	9	8	--	3	12	40	305,818
Schleicher	2	8	3	1	2	20	36	200,501
Scurry	27	--	7	--	--	3	37	162,748
Shackelford	79	5	58	7	1	25	175	335,011
Shelby	--	1	--	--	--	2	3	12,996
Sherman	--	1	1	--	--	1	3	10,486
Smith	2	--	1	4	--	13	20	152,678
Starr	12	22	24	2	4	7	71	412,119
Stephens	33	3	11	3	1	11	62	196,182
Sterling	--	--	--	1	--	4	5	31,400
Stonewall	13	--	7	1	--	24	45	206,986
Sutton	--	58	12	--	6	18	94	553,047
Taylor	39	1	16	4	1	23	84	312,098
Terrell	1	1	2	--	1	--	5	40,050
Terry	9	1	2	--	--	8	20	136,804
Throckmorton	35	--	31	2	--	19	87	214,912
Titus	6	--	3	--	--	5	14	69,966
Tom Green	--	--	5	--	1	3	9	40,616
Travis	--	--	1	--	--	5	6	17,100
Trinity	--	--	--	--	--	1	1	14,100
Tyler	--	--	6	1	--	7	14	11,291
Upshur	--	8	2	--	--	3	13	138,590
Upton	24	--	5	1	--	3	33	161,747
Van Zandt	5	1	--	--	--	6	12	102,072
Victoria	5	18	11	--	2	13	49	274,880
Walker	--	--	--	--	--	1	1	18,167
Waller	--	--	--	--	--	3	3	16,794
Ward	38	16	18	1	3	3	79	681,996
Washington	--	--	1	--	--	1	2	10,489
Webb	7	34	11	--	5	30	87	538,243
Wharton	22	36	28	3	15	28	132	645,749
Wheeler	8	--	1	--	2	3	14	115,595
Wichita	226	--	35	--	--	--	261	444,399
Wilbarger	117	--	33	--	--	11	161	316,771
Willacy	7		8	--	1	1	15	106,272
Williamson	--	--	1	--	--	3	4	3,557
Wilson	3	--	--	--	--	4	7	22,206
Winkler	13	4	3	1	--	4	25	169,280
Wise	1	13	7	--	1	3	25	163,232
Wood	14	1	9	1	--	4	29	181,113
Yoakum	41	--	3	--	--	8	52	321,716
Young	60	1	23	7	--	20	111	328,582
Zapata	7	4	5	--	2	8	26	124,909
Zavala	4	3	4	1	3	16	31	133,809
Offshore area	--	5	1	2	7	38	53	532,978
Total	3,784	760	1,149	179	183	1,611	7,666	39,339,135

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Significant Eocene discoveries included the Rabel field, Colorado County; Glidden field, Colorado County; and Dobbin South field, Montgomery County. Each of these discoveries was gas productive from Wilcox reservoirs.

East Texas (RRC districts 5 and 6) drilling activity declined 26.6% to 367 wells. Exploratory activity declined 6.9%, and proved field well drilling declined 37.0%. The Rodessa formation was the leader in important discoveries with five

Table 11.—Texas: Crude petroleum production, indicated demand, and stocks in 1972 by month

(Thousand 42-gallon barrels)

Month	Production	Indicated demand	End of month stocks originating within Texas
January	99,641	102,657	90,288
February	98,377	96,129	92,536
March	109,422	106,309	95,649
April	108,688	108,754	95,583
May	113,071	107,629	101,025
June	108,659	109,258	100,426
July	112,117	114,334	98,209
August	112,152	114,826	95,535
September	108,444	109,248	94,731
October	112,219	108,516	98,434
November	108,070	105,863	100,641
December	110,825	113,346	98,120
Total:			
1972	1,301,685	1,301,869	XX
1971	1,222,926	1,239,998	XX

XX Not applicable.

Table 12.—Texas: Input and output of refineries in 1972, by month

(Thousand 42-gallon barrels)

Month	Input		Output							
						Fuel Oil				
	Crude oil	Other products	Lube oils	Gasoline	Kerosine	Distillate	Residual	Jet fuel	Petrochemical feedstocks	Miscellaneous products
January	91,488	12,385	2,283	51,491	3,430	20,477	3,084	6,966	5,354	10,888
February	85,395	10,920	1,928	46,492	2,238	20,443	3,615	7,718	5,479	8,402
March	91,831	12,173	2,402	48,794	2,744	22,077	3,407	7,428	5,262	11,890
April	88,068	12,207	2,378	47,014	2,217	20,169	2,859	7,063	6,040	12,535
May	94,241	12,954	2,414	50,855	2,105	23,413	2,573	7,347	6,015	12,473
June	95,000	11,897	2,373	49,515	2,139	23,178	3,414	6,616	5,378	14,234
July	96,127	12,090	2,321	53,670	1,850	21,978	2,721	6,586	5,808	13,288
August	95,943	11,663	2,409	52,966	2,247	21,093	3,344	6,788	6,575	12,184
September	94,006	12,338	2,341	53,641	2,729	20,937	3,618	5,963	5,752	11,363
October	92,986	12,947	2,376	53,766	2,476	22,646	3,484	5,788	6,537	8,860
November	92,211	11,919	2,275	50,279	2,716	22,050	3,952	5,844	6,671	10,343
December	95,664	11,660	2,574	51,032	3,270	23,153	5,269	6,206	6,780	9,040
Total	1,112,960	145,153	28,074	609,515	30,161	261,614	41,290	80,313	71,646	135,500

Table 13.—Texas: Stocks of refined products held by refining and pipeline companies in 1972, by month

(Thousand 42-gallon barrels)

Month	Special naphthas	Gasoline	Kerosine	Fuel oil		Jet fuel	Miscellaneous products	Total refined products
				Distillate	Residual			
January	2,215	43,107	2,565	17,143	5,539	4,150	37,418	112,137
February	2,234	42,854	1,819	11,627	4,642	4,420	35,776	103,372
March	1,990	40,121	1,680	12,615	3,785	4,281	36,997	101,469
April	2,122	37,779	2,400	17,916	3,129	4,227	38,685	106,258
May	2,100	34,948	2,389	14,682	3,643	4,318	39,112	101,192
June	1,641	32,505	2,752	17,088	3,906	4,653	41,546	104,091
July	1,710	33,648	2,839	22,113	4,097	5,330	40,334	110,071
August	1,896	31,622	2,912	22,351	4,315	6,152	38,073	107,321
September	1,998	32,819	3,219	23,283	4,675	5,237	37,189	108,420
October	1,918	34,068	2,811	23,829	4,950	4,922	36,437	108,935
November	2,259	36,470	2,968	24,182	4,901	4,798	35,665	111,243
December	2,137	37,113	2,436	21,439	4,203	4,686	32,865	104,879

Table 14.—Texas: Stocks of crude petroleum at refineries, tank farms, and gathering systems in Texas as of the last day of each month, 1972

(Thousand 42-gallon barrels)

Month	Refineries	Tank farms and pipelines	Lease tanks	Total
January	13,227	59,461	4,895	77,583
February	14,759	60,212	4,899	79,870
March	14,658	62,271	4,888	81,817
April	14,955	60,585	4,479	80,019
May	15,216	64,812	4,887	84,915
June	15,401	64,647	4,824	84,872
July	16,353	63,391	4,856	84,600
August	15,141	61,160	4,801	81,102
September	17,069	59,938	4,774	81,781
October	16,487	62,021	4,828	83,336
November	14,313	63,180	4,765	82,258
December	13,552	59,992	4,787	78,331

successes. The North Sand Flat field in Smith County appears to be the most significant at this time.

Geophysical activity in West Texas declined 25.6% to 724 crew-weeks. Principally, the decline was in Reeves and Ward Counties, in the Delaware Basin. However, Pecos, Reeves, and Ward Counties continued as leaders in geophysical activity. They accounted for 44% of West Texas activity. Leasing activity increased in 1972. The university of Texas land sale in September attracted several bids in the $300 to $700 per acre range, and high bid for the sale was more than $800 per acre.

The second deepest test in the world was drilled in Pecos County. The Lowe Estate Well No. 1 was drilled to a total depth of 28,500 feet, but failed to establish commercial production. At total depth the well had penetrated strata of the Ellenburger formation.

The most active wildcat area in West Texas was the east Flank of the Delaware Basin in Ward and Winkler Counties. A significant discovery was made by Humble Oil and Refining Co. (Exxon Corp.) at its No. 1 Howe Gas Unit which was completed to produce gas from a Devonian age reservoir. Another indicated significant discovery was the Texas Pacific Oil Co., Inc. No. 1 Elsinore well completed to produce gas in Pecos County, on the south flank of the Delaware Basin from a Devonian reservoir.

One of the more active areas was Sutton County wherein 58 proved field wells were completed to produce gas. The principal productive zone was a sandstone reservoir of Canyon age. Another active development area was the Levelland-Slaughter-San Andres trend in Cochran and Hockley Counties, according to The American Association of Petroleum Geologists.[4]

Wells drilled in North-central Texas (RRC districts 7-B and 9) increased from 1,769 in 1971 to 1,803 in 1972. Exploratory drilling increased 8% to 448 wells and accounted for virtually all the gain.

Clay County with a total of 37 exploratory wells drilled was the leader in these districts. Other leading exploratory drilling activity was in Shackelford County, 33 wells; Taylor and Jones Counties, 28 wells; Young County, 27 wells; and Jack County, 23 wells.

In proved field well drilling, Wichita County continued to lead the area with a total of 261 wells that resulted in 226 oil producers and 35 dry holes.

In RRC district 10 drilling activity continued in the Anadarko Basin. Two important exploratory wells were completed to produce gas in Wheeler County. Freeport Oil Co. completed the No. 1 Fabian well to produce 93 million cubic feet of gas per day from a Hunton reservoir at a depth of 21,123 feet, and Kerr-McGee Corp. completed its No. 1 Holt well to produce 11 million cubic feet of gas per day from a lower Morrow sandstone reservoir at a depth of 18,105 feet.

Crude petroleum stocks above ground in Texas at yearend totaled 78.3 million barrels, a decrease of 4% from comparable yearend 1971 stocks. At refineries crude petroleum stocks totaled 13.6 million barrels, 3.9% less than at yearend 1971. Tank farms and pipeline stocks declined 4.3% to

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[4] Scott, R. J. Developments in West Texas and Eastern New Mexico in 1972. Am. Assoc. Petrol. Geol. Bull., v. 57, No. 8, August 1973, pp. 1503–1507.

60.0 million barrels, and lease stocks declined 1.6%.

Crude petroleum input to Texas refineries totaled 1,113 million barrels of which 2.1% was from foreign sources. Texas accounted for 26% of the crude petroleum input to refineries in the United States.

According to the Oil and Gas Journal annual survey,[5] the 40 operating refineries in Texas had a calendar day crude capacity of 3.49 million barrels at yearend, an increase of 20,000 barrels per day during the year. The State had 26.1% of total U.S. refining capacity. Although the number of refineries was unchanged, there was some construction activity to increase capacity and improve refinery capability of processing "sour crude oil" and producing low-lead gasoline products.

American Petrofina Company of Texas added 6,000 barrels per day of distillate hydrotreating capability to its Mt. Pleasant refinery. Additional equipment to increase catalytic reforming and hydrotreating capacities was being installed at yearend.

Cosden Oil & Chemical Co. started construction to upgrade gasoline production and increase aromatics extraction at its Big Spring refinery. Included in the expansion were a 20,0000-barrel-per-day catalytic reformer and a desulfurization unit.

Sun Oil Co. started construction to add 17,000 barrels per day of hydrotreating capability to its refinery at Nederland.

Texas City Refining, Inc. started work to increase vacuum distillation capacity by 25,000 barrels per day and fluidized catalytic cracking by 35,000 barrels per day at its Texas City refinery. Completion of these additions was scheduled for late 1973.

Union Oil Co. increased catalytic reforming capacity and catalytic hydrotreating capacity at its Nederland refinery from 20,000 to 36,000 barrels per day. The company also started expanding facilities to produce low-lead and eventually no-lead regular gasoline at its Beaumont refinery.

Diamond Shamrock Oil and Gas Co. started work to increase catalytic reforming and hydrotreating capability of its Sunray refinery. Scheduled completion for this construction was April 1973.

Mobil Oil Corp. increased fluidized catalytic cracking capacity to 55,000 barrels per day and thermal catalytic cracking to 66,000 barrels at its Beaumont refinery.

Phillips Petroleum Co. placed onstream a 26,000-barrel-per-day hydrodesulfurization unit at its Sweeny refinery. The unit removes sulfur from a light naptha stream to provide high-yield reformer charge stock. Hydrogen supply for this unit is provided from ethylene units within the plant.

Southwestern Oil and Refining Co. started construction in two phases to double capacity of its Corpus Christi refinery to 100,000 barrels per day. The first phase, scheduled for completion in mid-1973, involves construction of a crude oil distillation unit to increase capacity to 70,000 barrels per day of sweet crude oil. The unit will have the capability of processing 100,000 barrels per day of sour crude after additional downstream facilities are built.

Petrochemicals.—Texas continued as a leader in the manufacture and construction of facilities to produce petrochemicals. Among the construction activities completed or in progress were the following:

Amoco Chemicals Corp. completed a 150-million-pound-per-year polypropylene plant and a 100-million-pound-per-year high-density polyethylene plant at its Chocolate Bayou complex. The company also started construction of a 1-billion-pound-per-year ethylene plant in the complex. Completion was scheduled for late 1974.

Celanese Chemical Co. started construction of a 300-million-pound-per-year acrylate ester plant at Clear Lake. Completion was scheduled for late 1973. Celanese Plastics Co. expanded its plant in Houston to increase high-density polyethylene capacity by 120 million pounds per year, a 50% increase. Celanese thus became the largest producer of high-density polyethylene in the United States.

E. I. Du Pont de Nemours & Co., Inc. completed the largest single aniline plant in the world at Beaumont in Jefferson County. Anilene is used in many industrial applications including dyes, pharmaceuticals, and explosives.

The Monsanto Polymer & Petrochemicals Co. new 1.3-billion-pound-per-year styrene monomer plant at Texas City came onstream. The plant uses Monsanto's proprietary process featuring the use of a dehydrogenation reactor that combines reaction and reheat stages.

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[5] Cantrell, Ailleen. Annual Refining Survey. Oil and Gas J., v. 71, No. 14, Apr. 2, 1973, p. 91.

Petrochemical Investment Co. increased polystyrene capacity of its Houston plant to 52 million pounds per year.

Shell Oil Co. put its first orthoxylene unit onstream at its Houston plant. The 200-million-pound-per-year facility is reportedly one of the largest of its kind.

Texaco, Inc. completed an expansion and modernization of its aromatics plant at Port Arthur. Benzene and toluene manufacturing capacity were increased 20%.

Union Carbide Corp. modified equipment at its Texas City plant and increased productive capacity of linear alcohol ethoxylates by 35%. The move accents the reformulation of detergents because of concern about their biodegradability. Union Carbide Corp. also expanded its Seadrift plant. Ethanolamine capacity was increased by 35 million pounds per year and ethylene oxide capacity was increased by 100 million pounds annually.

U.S. Industrial Chemicals Co. completed an 80-million-pound-per-year high-density polyethylene plant at Houston. Reportedly, this is the first plant in North America to use the Solvay et Cie. technology.

NONMETALS

The value of nonmetals produced in Texas during 1972 totaled $447 million, a gain of 11%. Nonmetals accounted for 6.2% of the State's total mineral production value. In order of value the five principal nonmetals were cement, stone, sulfur, sand and gravel, and salt.

Increases were reported in the output of cement, bentonite, common clay, fire clay, fluorspar, kaolin, gem stones, gypsum, lime, perlite, salt, sand and gravel, natural sodium sulfate, crushed stone, sulfur, and talc; output of pumicite was unchanged. Declines in production were registered for ball clay, dimension stone, fuller's earth, graphite, and magnesium compounds. Barite, fluorspar, mica, perlite, and vermiculite, mined outside of Texas, were processed at plants in the State.

Barite.—No production of crude barite was reported in Texas during 1972, but several barite-grinding plants operated in the State. Two plants in Houston, one plant in Brownsville, and one plant in Corpus Christi processed crude barite that was mined outside of Texas. Most of the processed material was used as a weighting agent in well-drilling muds. Lesser amounts were prepared for use as fillers or extenders and for other purposes. Total output at the plants was about 14% greater than that in 1971.

Cement.—The cement industry, following the 1971 trend, again reached new highs in output. Shipments of portland cement from Texas plants during 1972 increased 9% and their total value increased 22%. Production of portland cement was up 10% for the year.

The portland cement was prepared at 18 plants located in Bexar, Dallas, Ector, Ellis, El Paso, Harris, McLennan, Nolan, Nueces, Orange, Potter, and Tarrant Counties. Raw materials used in making portland cement included limestone and argillaceous limestone (cement rock), caliche, clay and shale, sand, gypsum, limonite, and other ironbearing materials, bauxite, and fluorspar.

The average price of portland cement shipped from Texas plants during 1972 was $21.97 per short ton compared with $19.48 per short ton during 1971. About 7 million tons of portland cement were consumed in Texas during 1972. Most (60%) of the cement was used by ready-mix concrete companies; 8% went to manufacturers of concrete products, 7% to building-material dealers, and 25% to contractors and other users.

Table 15.—Texas: Portland cement statistics

(Short tons)

	1971	1972
Number of active plants	18	18
Production	7,137,985	7,884,308
Shipments from mills:		
Quantity	7,197,939	7,813,290
Value	$140,205,870	$171,641,532
Stocks at mills, Dec. 31	467,298	494,154

Table 16.—Texas: Masonry cement statistics

(Short tons)

	1971	1972
Number of active plants	12	14
Production	182,182	240,657
Shipments from mills:		
Quantity	169,275	216,634
Value	$4,514,294	$5,811,510
Stocks at mills, Dec. 31	18,795	22,730

Fourteen of the cement plants also prepared masonry cement. Production, totalling 240,657 short tons, was up 32% for the year. Shipments of masonry cement from the plants increased 28%, and value of shipments gained 29%. Over 179 thousand tons of masonry cement were used in Texas during 1972.

Several cement companies expanded plant facilities during the year. Annual production capacity at the Gifford-Hill Portland Cement Co. plant at Midlothian in Ellis County increased to 846,000 tons as the company's third kiln went onstream in July. The 12-foot by 450-foot rotary kiln has an annual capacity of 282,000 tons.

At the Texas Industries, Inc. plant at Midlothian, a fourth kiln went into production in March, raising the plant's annual capacity to 1.2 million tons. In addition to the 12-foot by 450-foot, wet-process kiln, the company completed installation of a 12-foot by 33-foot finish grinding mill at the plant.

Other expansions included installation of a new 12-foot by 33-foot finish mill at the San Antonio plant of Capitol Cement, a division of Capitol Aggregates, Inc. Also, Gulf Coast Portland Cement Co., a division of McDonough Co., was installing an 11-foot by 34-foot finish mill in its plant at Houston.

On June 1, the name of one of the cement producers in Texas was changed from General Portland Cement Co., to General Portland, Inc. The company's Trinity Division operates cement plants in Dallas, Fort Worth, and Houston. During the year, another cement producer, Ideal Basic Industries, Inc., announced plans to import cement into Houston from Venezuela by means of a converted oil tanker.

Clays.—Clay production—consisting of ball clay, bentonite, common clay, fire clay, fuller's earth, and kaolin—reached a record high in 1972. Output of all the clays except ball clay and fuller's earth increased during the year. Total tonnage was up 12% with a corresponding increase of 11% in total value. Fifty-four producers reported production from 80 clay mines in 46 Texas counties. Leading in clay output during the year were Eastland, Bexar, Chambers, Fort Bend, and Limestone Counties.

Common clay made up almost 95% of the total clay output. Production, reported in 40 counties, increased 12% for the year. Approximately 30% of the common clay was used to prepare lightweight and standardweight aggregate. Other uses were in the manufacture of portland cement, face and common brick, pottery, structural and quarry tile, and other clay products.

Ball clay was mined in Cherokee County for use in making floor and wall tile. Bentonite, mined in Angelina, Fayette, Gonzales, and Walker Counties, was used as an additive in drilling muds, an animal-feed filler, and a filtering and decolorizing agent, and for other purposes. Fire clay was obtained in Bastrop, Cherokee, and Wood Counties for use in the manufacture of firebrick and block and other products. Production of fuller's earth was reported in Brewster and Fayette Counties, and kaolin was produced in Limestone County.

New operations were developed in Texas during 1972 to produce clays for the manufacture of aggregate material. Superrock, Inc., began mining clay in southeastern Navarro County for use at the company's new lightweight-aggregate plant near Streetman. Also, Quanah Lightweight, Inc., planned to produce clay east of Quanah in Hardeman County for use in the manufacture of road-construction aggregates.

In western Texas, El Paso Brick Co. announced plans to construct a new brick-manufacturing plant at El Paso with pro-

Table 17.—Texas: Clays sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Year	Bentonite		Fire clay		Common clay and shale		Total [1]	
	Quantity	Value	Quantity	Value	Quantity	Value	Quantity	Value
1968	92	611	766	1,988	3,756	5,388	4,687	8,860
1969	100	655	635	1,669	3,593	5,402	4,407	8,664
1970	74	839	351	1,834	3,550	4,945	4,148	9,587
1971	W	W	W	W	4,374	7,098	4,615	10,432
1972	88	1,128	89	684	4,894	7,872	5,175	11,554

W Withheld to avoid disclosing individual company confidential data; included in "Total."

[1] Includes ball, kaolin, fuller's earth, and data indicated by symbol W.

duction capacity of 25 million bricks annually. In Winkler County, the R. C. Crabb Co. announced the planned construction of a new plant for the manufacture of ceramic tile at Wink, Tex.

In East Texas, Morrison Ceramics, Inc., expanded its ceramic plant at Athens in Henderson County and acquired additional clay deposits. The company manufactures stoneware, floor tile, lamp bases, and pottery.

Fluorspar.—Production was reported from one mine in 1972. D & F Minerals Co. produced metallurgical-grade fluorspar from open pits in the Christmas Mountains northwest of Big Bend National Park in Brewster County. The mine, La Mina Paisano, was developed in 1971.

Fluorspar, brought into the State from Mexico, was processed at plants in Brownsville, Eagle Pass, and Marathon.

Gem Stones.—No gem stone mines operated in Texas during 1972, but dealers and hobbyists collected rock and mineral specimens having an estimated value of $163,000. Agate, calcite, celestite, jasper, cinnabar, feldspar, fluorite, fossiliferous limestone, opal, petrified wood, tektites, quartz, and topaz were included in the specimens collected.

Graphite.—The only domestic producer, Southwestern Graphite Co., a division of Joseph Dixon Crucible Co., mined crystalline flake graphite at an open pit operation in western Burnet County. The graphite was processed at the company mill near the mine. Production in 1972 was less than during the previous year, although total value of sales increased. Natural graphite is used for crucibles and foundry facings, as a dry lubricant, and in pencils and other products.

Gypsum.—Gypsum production in Texas reached an alltime high in 1972. Output was up 18% for the year and total value increased 10%. The production of 1,542,170 short tons of crude gypsum in 1972 exceeded by 14% the previous record-high production of 1,351,060 short tons in 1959. Average price per short ton during 1972 was $3.43 compared with $3.69 in 1971 and $3.52 in 1959.

Seven companies produced the crude gypsum from surface mines in five Texas counties—The Celotex Corp. and National Gypsum Co. in Fisher County, Fredericksburg Gypsum Co. in Gillespie County, Georgia-Pacific Corp. in Hardeman County, Southwestern Portland Cement Co. in Hudspeth County, and Flintkote Co. and United States Gypsum Co. in Nolan County.

Eighty-four percent of the cubic gypsum was calcined at seven plants located in Dallas, Fisher, Hardeman, Harris, and Nolan Counties. Output of calcined gypsum, amounting to 1,294,143 short tons, was 25% greater than that of the previous year. The calcined gypsum was used in the manufacture of products such as wallboard and plasters. Some of the crude gypsum was used as a retarder in portland cement, as a filler, and as a soil conditioner in agriculture.

Lime.—With an output of 1,630,995 short tons, Texas ranked fourth among the States in lime production during 1972. Texas output, which increased only 1% during the year, was 2% less than the record-high production of 1970. Total value of quicklime and hydrated lime produced in the State in 1972 was down 10% from that of 1971.

Thirteen companies prepared the lime at 15 plants in Bexar, Bosque, Brazoria, Calhoun, Comal, Deaf Smith, Harris (three plants), Hill, Jasper, Johnson, Nueces, Travis, and Williamson Counties. Leading in output were Nueces, Johnson, and Travis Counties.

The lime was used in soil stabilization; water purification; the manufacture of alkali compounds and paper and pulp; the preparation of magnesia and magnesium metal, chrome, aluminum, and sugar; and for other purposes. Texas lime consumption totaled 1,626,000 short tons. Most of the lime shipped out of State went to Louisiana and Oklahoma.

Mica.—No mica mines operated in Texas during 1972. Out-of-State mica was processed at the Fort Worth grinding plant of Western Mica Co., Division of United States Gypsum Co. The ground mica was used in the manufacture of joint cement and paint.

Perlite.—One company reported production of crude perlite in Texas during 1972. Perlite Industries, Inc. a division of Texas American Sulphur Co., and a subsidiary of Texas American Oil Corp., of Midland, Tex., obtained the perlite from an open pit mine in the Pinto Canyon area of Presidio County, about 40 miles southwest

Table 18.—Texas: Lime sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Construction	470	6.134	565	7.451
Water purification	142	1.918	125	1.722
Paper and pulp	90	1.692	60	851
Oil well drilling	10	159	9	120
Other uses [1]	900	14.680	872	12.037
Total	1,612	24.583	1.631	22.181

[1] Includes alkalies, aluminum and bauxite, petrochemicals, electric furnaces, chrome, open-hearth furnaces, miscellaneous chemicals, magnesia from sea water, sugar refining (1972), magnesium metal, sewage treatment, petroleum refining, insecticides, food, agriculture, and fertilizer (1972).

of Marfa, Tex. The company operates a perlite processing plant near Midland, Tex.

Perlite mined outside of the State was expanded at two plants located in Dallas, Harris (two plants), and one each in Midland, Tarrant, and Noland Counties. Total output of processed perlite in Texas during 1972 amounted to 21,696 short tons. The expanded perlite was used as filter aid, plaster and concrete aggregate, horticultural aggregate, low-temperature insulation, filler, roof-insulation board, and masonry- and cavity-fill insulation. The use of perlite as an aggregate in concrete increased 36% during 1972.

Pumicite (Volcanic Ash).—Rio Clay Products, a division of Pozzolana Corp., mined pumicite from an open pit near Rio Grande City in Starr County during 1972. The organization is affiliated with Nordmeyer, Inc., which reported production there in 1971. The processed material was used chiefly as an admixture in oilwell cement and as an insecticide carrier in crop dusting. Output was virtually the same as that of the previous year.

Salt (Sodium Chloride).—Texas ranked second among the States in salt production, accounting for 22% of the Nation's salt output. Texas production—comprising brine, evaporated salt, and rock salt—totaled 9.7 million short tons valued at $36.5 million. Production increased 6% during 1972, but was 4% under the record high of 1970.

The salt was obtained from salt domes of the Texas Gulf Coastal Plain and from underground salt beds in West Texas. Nine companies reported production from 12 operations in Brazoria, Chambers, Duval, Fort Bend, Harris, Hutchinson, Jefferson, Matagorda, Van Zandt, Ward, and Yoakum Counties. The salt was produced as brine through wells and as rock salt from two underground mines.

The State's chemical manufacturing industry utilized large amounts of salt in the manufacture of chlorine, caustic soda (sodium hydroxide), soda ash (sodium carbonate), and other chemicals. Salt also was used in food products, for water softening, and for numerous other purposes.

During the year, one of the Texas salt producers, Diamond Shamrock Corp., announced the planned construction of a new plant in the Houston area for the production of chlorine and caustic soda. The plant was scheduled for completion in 1974.

Table 19.—Texas: Salt sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value
1968	8,534	42.663
1969	9,261	43,012
1970	10,184	45.000
1971	9,217	40.838
1972	9,744	36.544

Sand and Gravel.—Production of sand and gravel in Texas, totaling 35,151,000 short tons, increased 7% during the year. Total value was up 9%. The 1972 output almost equalled the record-high production of 35,295,000 short tons that was reached in 1959. Texas ranked seventh among the States in sand and gravel output during 1972.

Production was reported from 145 commercial and noncommercial (government and contractor) operations in 61 of the State's 254 counties. Leading in output were Colorado, Dallas, Victoria, Tarrant, and McLennan Counties.

Table 20.—Texas: Sand and gravel sold or used by producers

(Thousand short tons and thousand dollars)

Year	Commercial		Government-and-contractor		Total sand and gravel [1]	
	Quantity	Value	Quantity	Value	Quantity	Value
1968	27,919	38,183	3,924	3,368	31,843	41,546
1969	24,226	33,123	5,746	6,633	29,972	39,756
1970	27,464	42,252	3,978	4,110	31,438	46,362
1971	29,607	48,831	3,181	2,983	32,788	51,814
1972	33,036	54,658	2,115	1,670	35,151	56,328

[1] Data may not add to totals shown because of independent rounding.

Table 21.—Texas: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Qunatity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	9,017	13,959	10,108	13,932
Fill	760	563	2,897	3,381
Molding	W	W	104	345
Paving	4,157	5,198	3,068	4,419
Other uses [1]	1,733	5,471	1,539	4,310
Total [2]	15,668	25,192	17,719	26,385
Gravel:				
Building	8,207	14,396	9,506	17,588
Fill	231	87	2,023	2,885
Paving	4,937	8,146	3,497	7,464
Miscellaneous	W	W	128	114
Other uses [3]	565	1,012	165	222
Total [2]	13,940	23,641	15,317	28,272
Government-and-contractor operations:				
Sand:				
Building	159	42	11	11
Fill	1	([4])	2	4
Paving	417	539	1,045	664
Total [2]	578	581	1,058	679
Gravel:				
Building	63	82	38	34
Fill	130	106	37	13
Paving	2,379	2,200	982	944
Other uses	31	14	--	--
Total [2]	2,604	2,402	1,057	991
Total sand and gravel [2]	32,788	51,814	35,151	56,328

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes railroad ballast (1972), blast, engine, filtration, glass, grinding and polishing (1972), abrasives (1972), chemical (1972), enamel, fill, foundry, oil (hydrofrac), pottery, porcelain, and tile, and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes railroad ballast (1972) and other gravel.

[4] Less than ½ unit.

Commercial production, reported by 84 companies at 129 operations, made up 94% of the total output. Average price of commercially produced sand was $1.49 per short ton; average price of commercially produced gravel was $1.85. Seventy-nine % of the sand and gravel produced at commercial operations was used for building and paving. Other uses, such as for fill and railroad ballast, and industrial sands accounted for the remaining 21% of commercial output. Industrial sands produced during the year included abrasive, blast, enamel, engine, filtration, foundry, glass, grinding and polishing, hydraulic-fracturing, molding, and pottery sands.

A new sand and gravel plant began operations in 1972. The fully automated Arena plant of Thorstenberg Materials Co., a subsidiary of Ideal Cement Co., located about 15 miles south of Columbus, Tex., in Colorado County, has a capacity of 750 tons of finished sand and gravel per hour.

Sodium Sulfate (Natural).—Ozark-Mahoning Co. obtained sodium-sulfate brines from shallow wells drilled into alkali-lake beds in Gaines and Terry Counties. The brines were processed into salt cake at the company's plants near Brownfield and Seagraves. Output and total value increased during 1972. Salt cake is used in the manufacture of kraft paper, glass, detergents, and other products.

Stone.—Production of all stone, crushed and dimension, in Texas during 1972 totaled 49.3 million short tons. The output was 20% greater than that of 1971. Wise County led in stone production, followed by Williamson, Bexar, Comal, and Calhoun Counties.

Production of crushed stone, reported from 189 quarries during 1972 accounted for nearly all of the stone output. Eighty-six percent of the crushed stone consisted of limestone and dolomite, and 10% consisted of shell. The remaining 4% comprised basalt (traprock), granite, marble, marl, metarhyolite, sandstone, and quartzite. Crushed stone output increased almost 20% in 1972, with a 7% increase in total value. The 19% decline in shell production and the 56% drop in output of crushed sandstone and quartzite were offset by a 34% increase in the production of crushed limestone and dolomite. The crushed stone was used as concrete aggregate and other aggregate, road base stone, railroad ballast, agstone, riprap, flux stone, terrazzo chips, whiting, raw material in preparing cement and lime, and for other purposes.

Dimension stone was produced at eight quarries in 1972. Granite for use as dimension stone was obtained from three quarries in Burnet County and from one quarry in Llano County. Limestone was produced for use as dimension stone at one quarry in Gillespie County, two quarries in Jones County, and one quarry in Williamson County. The dimension stone was prepared as rough blocks, sawed and cut stone, house stone veneer, flagging, and monument stone.

Gifford-Hill & Co., Inc., a major producer of aggregate materials in Texas, began production at its enlarged crushed stone plant near Bridgeport in Wise County. With a yearly production capacity of 3.2 million tons of limestone, the plant is one of the largest crushed-stone facilities in the United States. The wet process used at the plant eliminates nearly all dust-related air pollution.

In Johnson County, Cleburne Crushed Stone Co., Inc., opened a new limestone-crushing plant near Cleburne. Another limestone producer in Johnson County, Rangaire Corp., parent company of Texas Lime Co., announced that it had increased its limestone reserves by 6.2 million tons with the purchase of 1,800 additional acres of land in the county.

In Bell County, Belton Minerals Co. announced the purchase of a crushed-limestone plant near Belton that formerly was owned by Belton Development Co. Also in 1972, Texas Quarries, Inc., a producer of dimension limestone in Williamson County, was acquired by Kingstip, Inc., parent company of the Featherlite Corp., a clay producer and manufacturer of lightweight aggregate.

Table 22.—Texas: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone total	22	W	24	W
Crushed and broken:				
Limestone and dolomite	31,725	46,314	42,559	55,799
Granite	W	W	W	416
Sandstone, and quartzite	2,405	5,510	1,058	2,121
Shell	5,985	8,482	4,864	7,298
Other stone [1]	1,030	1,838	809	939
Total crushed	[2] 41,146	62,144	49,290	66,573

W Withheld to avoid disclosing individual company confidential data.

[1] Includes granite (1971), marble, marl, traprock, and data where symbol W appears for crushed and broken stone.

[2] Data do not add to total shown because of independent rounding.

Sulfur.—Production of native sulfur by the Frasch method increased substantially during 1972. Four companies mined the sulfur at eight Frasch operations in six counties. Five of the operations were on the Texas Gulf Coast where the sulfur was obtained from the caprock of Long Point salt dome in Fort Bend County, Fannett and Spindletop salt domes in Jefferson County, Moss Bluff salt dome in Liberty County, and Boling dome in Wharton County. In West Texas, the sufur was produced from underground deposits in Permian strata at one operation in Culberson County and at two operations in Pecos County. One of the Pecos County sulfur plants, that of Duval Corp., a subsidiary of Pennzoil Co., closed during 1972. The company, however, continued its sulfur operation in Culberson County.

Sulfur also was recovered from sour (sulfur-bearing) natural gas and petroleum at 47 plants in 26 Texas counties during the year. In addition, one company reported sales of stockpiled sulfur from its inactive recovery (from gypsum) plant in Culberson County.

Sales of recovered sulfur from Texas plants totaled 846,739 long tons valued at $11,135,227. The amount of recovered sulfur that was sold increased 10% during the year with an 8% increase in total value. Average price in 1972 was $13.15 per long ton, compared with a price of $13.31 in 1971 and $17.71 in 1970.

Talc and Soapstone.—Texas ranked second among the States in talc and soapstone production during 1972. Output from Texas mines totaled 221,022 short tons, valued at $1,261,708. Production was up 14% for the year and total value gained 23%. Average value per short ton of the crude, unground material was $5.71 in 1972 compared with $5.28 in 1971.

All of the State's production was from West Texas. Five producers—Cyprus Mines Corp., Pioneer Talc Co., Inc., Southern Clay Products, Inc., Texas Talc Co. (a subsidiary of Dallas Ceramic Co.), and Westex Talc Co. (a subsidiary of Milwhite Co., Inc.)—obtained the talc and soapstone from six surface mines in the Allamoore area of Hudspeth County. One of the companies, Westex Talc Co., also produced soapstone in Culberson County at the Tumbledown Mountain surface mine north of Van Horn, Tex.

The talc and soapstone, after grinding, was consumed in the preparation of ceramics, paint, insecticides, roofing, textiles, and other products. Some also was exported.

Vermiculite.—No vermiculite was mined in Texas during 1972. Two companies, however, processed out-of-State vermiculite at plants in three Texas cities. Texas Vermiculite Co. exfoliated the material at two plants—one in Dallas and another in San Antonio. Vermiculite Products, Inc., operated an exfoliating plant in Houston. Total output from the three plants was greater than that of the previous year.

The expanded vermiculite was used as concrete aggregate, plaster aggregate, loose-fill insulation, and fireproofing material, and for horticulture, agriculture and other purposes.

METALS

The value of metal minerals mined in the State declined to $58 million, less than 1% of total mineral value. Metals mining included iron ore, mercury, and uranium; and magnesium was recovered from seawater and brine. However, other metallic minerals including aluminum, antimony, cadmium, copper, lead, manganese, tin, and zinc were recovered at smelters, refineries, and reduction plants.

Table 23.—Texas: Sulfur produced and shipped from Frasch mines

(Thousand long tons and thousand dollars)

Year	Production	Shipments	
		Quantity	Value [1]
1968	3,203	[r] 2,663	[r] 109,324
1969	3,289	[r] 2,616	[r] 67,676
1970	3,446	[r] 2,844	[r] 63,321
1971	3,408	[r] 3,092	W
1972	3,755	3,847	W

[r] Revised. W Withheld to avoid disclosing individual company confidential data.

[1] F.O.B. mine plant.

Table 24.—Texas: Smelters, refineries, and reduction plants in 1972

Product, company, and plant	Location (county)	Material treated
Aluminum:		
Aluminum Company of America:		
Point Comfort (alumina)	Calhoun	Bauxite.
Point Comfort (reduction)	do	Alumina.
Rockdale (reduction)	Milam	Do.
Reynolds Metals Co.:		
Sherwin Works (alumina)	San Patricio	Bauxite.
San Patricio (reduction)	do	Alumina.
Antimony:		
NL Industries, Inc.:		
Laredo smelter	Webb	Ore.
Cadmium:		
American Smelting & Refining Co.:		
Electrolytic	Nueces	Flue dust.
Copper:		
American Smelting & Refining Co.:		
El Paso smelter	El Paso	Ore and concentrates.
Phelps Dodge Refining Corp.:		
Nichols refinery	do	Blister and anode.
Iron:		
Lone Star Steel Co.:		
Daingerfield plant	Morris	Ore and scrap.
Armco Steel Corp.:		
Houston plant	Harris	Do.
United States Steel Corp.:		
Cedar Point Plant	Chambers	Do.
Lead:		
American Smelting & Refining Co.:		
El Paso smelter	El Paso	Ore and concentrates.
Magnesium:		
The Dow Chemical Co.:		
Freeport plants, Electrolytic	Brazoria	Sea water.
Manganese:		
Tenn-Tex Alloy Corp	Harris	Ore.
Sodium:		
Ethyl Corp	do	Brine.
Tin-Tungsten:		
Gulf Chemical & Metallurgical Corp.:		
Texas City smelter	Galveston	Ore.
Zinc:		
American Smelting & Refining Co.:		
Amarillo retort smelter	Potter	Ore and concentrates.
Corpus Christi electrolytic	Nueces	Do.
El Paso fuming plant	El Paso	Dusts and residues.

Aluminum.—Primary aluminum output and value decreased 27% and 35% respectively in Texas. The output was counter to the national trend which increased 5%. Aluminum Company of America (Alcoa) shutdown two of eight potlines at its Rockdale works. The curbing of output was attributed to a shortage of natural gas and power supplied by Texas utilities. Alcoa installed new production facilities for hydrated alumina at its Point Comfort plant.

Reynolds Metals Co. installed a mixed gas fluxing process at its reduction plant in Corpus Christi. The process, according to Reynolds, allows molten aluminum to be fluxed and degassed with significantly less chlorine and particulate emissions and no operating impairment to remelt furnaces.

The first aluminum container reclamation center in Central Texas was opened in Austin by Brown Distributing Co. Aluminum cans are shredded and the scrap metal sold to Reynolds Metals Co. where it is recycled for use in packaging nonedible products. The Miller Brewing Co. opened three aluminum container reclamation centers, two in Fort Worth and one in Dallas.

Antimony.—Primary antimony metal was produced by NL Industries, Inc. at its Laredo smelter, principally from ores imported from Mexico. Output increased 21% over the 1971 level.

Cadmium.—This metal was recovered as a byproduct of processing zinc bearing ores. ASARCO recovered cadmium at its Corpus Christi facility.

Copper.—Ores and concentrates from other States and foreign nations were processed by ASARCO and Phelps Dodge Refining Corp. at their El Paso operations. Although deposits of copper minerals are known to exist in the Trans-Pecos region, in the Permian "red beds" of North Cen-

Table 25.—Texas: Secondary metal recovery plants

County and company	Material	Products
Dallas:		
Abasco, Inc	Aluminum scrap	Aluminum ingots, dioxidizing bars and shot.
American Smelting & Refining Co.	Lead and zinc scrap	Lead and zinc ingots, pigs, alloys.
Dixie Lead Co	Lead scrap	Lead pigs, alloys, chemicals.
NL Industries, Inc., Southwestern Branch	Battery plates	Lead products.
Southern Lead Co	----do	Lead pigs, alloys.
El Paso:		
Border Steel Mills, Inc	Steel scrap	Steel shapes, reinforcing bars.
Gregg:		
R. C. LeTourneau, Inc	----do	Heavy mobile equipment.
Guadalupe:		
Structural Metals, Inc	----do	Structural steel reinforcing bars.
Harris:		
A & B Metal & Smelting Co	Aluminum, lead scrap	Lead pigs, ingots, aluminum ingots, alloys.
Federated Metals	Various metals	Lead products, alloys of copper, lead, zinc, magnesium, tin.
Gulf Reduction Corp	Aluminum, zinc scrap	Aluminum and zinc ingots, alloys.
Houston Lead Co	Lead scrap	Lead pigs, ingots, alloys.
Houston Fishing Tackle Co	Soft lead scrap	Lead products.
Lead Products, Inc	Lead scrap	Lead pigs, ingots, alloys.
Magnus Metal	Various metal scrap	Lead, brass, bronze bearing metal.
Southwest Saw Corp	Steel scrap	Steel alloys.
Sterling Type, Rule & Metals Co	Type metal	Type metal.
Yulcan Detinning Co	Tinned scrap	Refined tin, baled detinned steel.
Tarrant:		
National Metal & Smelting Co	Battery lead and aluminum scrap	Lead pigs, ingots, battery metal, aluminum ingots.
Texas Steel Co	Steel scrap	Carbon and alloy steel bars and shapes, reinforcing bars.

tral Texas, and in the Central Mineral region (Llano uplift), no production has been reported in recent years.

ASARCO completed installation of facilities to utilize the Bayer/Lurgi double catalysis process for production of sulfuric acid from smokestack emissions of sufur dioxide gas at its El Paso metallurgical complex. The addition became operational in December.

Iron Ore.—Large deposits of iron ore in the form of siderite and limonite are present in northeast Texas, and small deposits in the form of magnetite occur in Precambrian rocks of the Central Mineral region. Deposits in northeast Texas in Cass, Morris, and Nacogdoches Counties were mined in 1972. Output declined 15%, and value declined 13% from those of 1971. Most of the output was used in the manufacture of iron and steel.

In Corpus Christi Shredded Steel, Inc., operated a 380,000 pound machine capable of shredding 4,000 car bodies per month. The machine, a Newel Auto fragmentizer can produce about 25,000 tons of usable scrap steel per year.

At yearend, United States Steel Corp. was testing its new works at Cedar Point, about 35 miles from Houston. This new complex has a rated capacity of more than 1 million tons of high-strength alloy and carbon plate steel per year.

Lead.—Lead minerals are known to exist in Hudspeth, Presidio, and Brewster Counties and in the Central Mineral region. However, no production has been reported in recent years. Lead was recovered from ores and concentrates, imported principally from Mexico, at the ASARCO El Paso smelter. Secondary recovery of lead was widespread, as can be noted in the listing of secondary metal recovery plants.

Magnesium Compounds.—The Dow Chemical Co. produced magnesium chloride, magnesium hydroxide, and caustic-calcined magnesia at Freeport in Brazoria County. Seawater from the Gulf of Mexico was the basic raw material. Also during 1972, A. P. Green Refractories Co., a subsidiary of United States Gypsum Co., used magnesium hydroxide, supplied by Dow, to prepare magnesium oxide (refractory magnesia). Following a suspension of operations in 1971 because of environmental constraints, American Magnesium Co. installed new Russian Allunion Aluminum Magnesium Institute (VAMI) cells at its Snyder plant to reduce air pollution. Some operational tests were conducted in 1972.

Magnesium compounds were used in the production of magnesium metal, and by the cement, ceramic, chemical, petroleum, rayon, rubber, and other industries.

Manganese.—Silicomanganese and ferromanganese were produced by the Tenn-Tex Alloy Corp. at its Harris County plant. Feedstock ores were imported from foreign countries.

Mercury.—Texas ranked sixth in production following more than a 50% decline in the States mercury output. The Whit-Roy mine, operated by The Anchor Co. in Presidio County, was the only active mercury mine in Texas in 1972. Value continued to decline, and the average quoted price at New York was $218.28 per 76-pound flask, a decrease of 25% from the 1971 level.

The outlook for the Study Butte mine in Brewster County which was shut down in June 1971 is particularly bleak. The influx of water into the mine from adjacent abandoned workings through connecting fissures had been a problem during mining operations. Pumping operations were discontinued in 1971 and the mine flooded. Because of the cost of dewatering the mine, it will probably not be reopened unless mercury prices increase substantially.

Sodium.—Metallic sodium was produced by the electrolytic processing of brine feedstock by Ethyl Corp. at its plant near Houston. The output was used principally to produce tetraethyl and tetramethyl lead, two compounds added to hydrocarbon fuels to increase antiknock ratings.

Tin.—Gulf Chemical & Metallurgical Corp. recovered tin and tin alloys at its Texas City smelter. Ore and concentrate feedstocks were imported, principally from Bolivia.

Uranium.—Output increased 11%, and Texas ranked third among the producing States. According to the U.S. Atomic Energy Commission, uranium ore reserves in 55 known deposits in Texas totaled 10.67 million tons based upon an $8 per pound value. Average uranium oxide (U_3O_8) content was 0.152%. Reserves of U_3O_8 totaled 16,249 tons, 5.95% of the U.S. total.

Uranium drilling declined from 3.87 million to 3.34 million feet in 1972, a decline of 14%, whereas nationwide drilling was virtually unchanged. Texas accounted for 21.7% of the U.S. uranium drilling footage. Acreage held for uranium mining and exploration declined from 899,000 acres to 641,000 acres, a 29% reduction.

Zinc.—Recovery of zinc at smelters and refineries declined 12%. Shutdown of the American Zinc Co.'s Dumas retort smelter before yearend 1971 contributed to the decline. The Texas State Air Control Board and ASARCO agreed to a temporary variance for continued operation of ASARCO's Amarillo retort smelter.

Table 26.—Texas: Principal producers

Commodity and company	Address	Type of activity	County
Asphalt (native):			
Uvalde Rock Asphalt Co	P.O. Box 531 San Antonio, Tex. 78206	Mine	Uvalde.
White's Uvalde Mines, Inc.	P.O. Box 499 San Antonio, Tex. 78206	do	Do.
Barite:			
Dresser Minerals	P.O. Box 6504 Houston, Tex. 77005	Grinding plant	Cameron.
The Milwhite Co., Inc	P.O. Box 15038 Houston, Tex. 77020	do	Harris.
National Lead Co	P.O. Box 1675 Houston, Tex. 77001	do	Nueces.
Carbon black:			
Ashland Chemical Co	P.O. Box 1503 Houston, Tex. 77005	Furnace	Aransas and Wheeler.
Cabot Corp	125 High St. Boston, Mass. 02110	Channel	Carson.
Do	do	Furnace	Gray and Howard.
Columbian Carbon Co	380 Madison Ave. New York, N.Y. 10017	do	Montgomery and Terry.
Do	do	Channel	Gaines.
Continental Carbon Co	P.O. Box 22085 Houston, Tex. 77027	Furnace	Moore.
J. M. Huber Corp	P.O. Box 831 Borger, Tex. 79066	do	Harris and Hutchinson.

Table 26.—Texas: Principal producers—Continued

Commodity and company	Address	Type of activity	County
Carbon black—Continued			
Phillips Petroleum Co	Bartlesville, Okla. 74003	Furnace	Hutchinson and Orange.
Sid Richardson Carbon & Gasoline Co.	1200 Ft. Worth National Bank Bldg. Ft. Worth, Tex. 76102	----do	Howard.
Cement:			
Alpha Portland Cement Co.	15 South Third St. Easton, Pa. 18042	Quarry and plant	Orange.
Capitol Aggregates, Inc	Route 13, Box 412 San Antonio, Tex. 78209	Plant	Bexar.
Centex Cement Corp	P.O. Box 9294 Corpus Christi, Tex. 78408	Quarry and plant	Nueces.
General Portland Cement Co.	2800 Republic Bank Tower Dallas, Tex. 75201	----do	Dallas, Harris, Tarrant.
Gifford-Hill Portland Cement Co.	P.O. Box 520 Midlothian, Tex. 76065	----do	Ellis.
Gulf Coast Portland Cement Co., Division of McDonough Co.	P.O. Box 262 Houston, Tex. 77001	----do	Harris.
Ideal Cement Co., division of Ideal Basic Industries Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	----do	Do.
Kaiser Cement & Gypsum Corp.	Permanente Rd. Permanente, Calif. 95014	Plant	Bexar.
Lone Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	Quarry and plant	Harris and Nolan.
San Antonio Portland Cement Co.	P.O. Box 6925 San Antonio, Tex. 78209	----do	Bexar.
Southwestern Portland Cement Co.	P.O. Box 392 El Paso, Tex. 79943	----do	Ector and El Paso.
Texas Industries, Inc	P.O. Box 146 Midlothian, Tex. 76065	----do	Ellis.
Universal Atlas Cement Div., United States Steel Corp.	600 Grant St. U.S. Steel Bldg. Pittsburgh, Pa. 15230	----do	McLennan.
Clay and shale:			
Acme Brick Co., Division of Justin Industries, Inc.	P.O. Box 425 Ft. Worth, Tex. 76101	Mine and plant	Denton, Nacogdoches, Parker, Wise, Van Zandt.
Balcones Mineral Corp	P.O. Box B Flatonia, Tex. 78941	----do	Fayette.
Dresser Minerals	P.O. Box 6504 Houston, Tex. 77005	----do	Angelina and Limestone.
Elgin Butler Brick Co	4000 East Ave. Austin, Tex. 78767	----do	Bastrop.
Featherlite Corp	P.O. Box 141 Ranger, Tex. 76470	----do	Bexar and Eastland.
General Portland Cement Co.	P.O. Box 2698 Dallas, Tex. 75201	----do	Dallas and Limestone.
General Refractories Co	1520 Locust St. Philadelphia, Pa. 19102	----do	Cherokee.
Gulf Coast Portland Cement Co., Division of McDonough Co.	P.O. Box 262 Houston, Tex. 77001	----do	Chambers.
Henderson Clay Products Co.	P.O. Box 1251 Henderson, Tex. 75652	----do	Rusk.
Lone Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	----do	Fisher and Harris.
The Milwhite Co., Inc	P.O. Box 15038 Houston, Tex. 77020	----do	Fayette and Walker.
Southern Clay Products, Inc.	P.O. Box 44 Gonzales, Tex. 78629	----do	Angelina, Cherokee, Gonzales.
Texas Clay Products, Inc	P.O. Box T Malakoff, Tex. 75148	----do	Henderson.
Texas Industries, Inc	8100 Carpenter Freeway Dallas, Tex. 75247	----do	Dallas, Marion, Comanche, Ellis, Fort Bend, Henderson, Van Zandt.
Coal (lignite):			
Atlas Chemical Indust., Inc.	P.O. Box 790 Marshall, Tex. 75670	Strip mine	Harrison.
Industrial Generating Co	P.O. Box 1111 Rockdale, Tex. 76567	----do	Freestone and Milam.
Flourspar:			
D & F Minerals Co	P.O. Box 75 Terlingua, Tex. 79852	Mine	Brewster.
Graphite:			
Southwestern Graphite Co.	Burnet, Tex. 78611	----do	Burnet.

Table 26.—Texas: Principal producers—Continued

Commodity and company	Address	Type of activity	County
Gypsum:			
The Celotex Corp	1500 North Dale Mabry Tampa, Fla. 33607	Open pit mine and calcining plant.	Fisher.
The Flintkote Co	480 Central Ave. East Rutherford, N.J. 07073	do	Nolan.
Georgia-Pacific Corp	P.O. Box 311 Portland, Oreg. 97207	do	Hardeman.
National Gypsum Co	325 Delaware Ave. Buffalo, N.Y. 14202	do	Fisher.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Nolan.
Do	do	Plant	Harris.
Iron ore:			
Lone Star Steel Co	P.O. Box 12226 Dallas, Tex. 75225	Open pit	Cass and Norris.
Tex-Iron, Inc	Cushing, Tex. 75760	do	Nacogdoches.
Lime:			
Aluminum Co. of America	1028 Alcoa Bldg. Pittsburgh, Pa. 15219	Plant	Calhoun.
Armco Steel Corp	P.O. Box 1367 Houston, Tex. 77001	do	Harris.
Austin White Lime Co	General Delivery McNeil, Tex. 78651	do	Travis.
Champion Papers, Inc	P.O. Box 872 Pasadena, Tex. 77501	do	Harris.
The Dow Chemical Co	2020 Dow Center Midland, Mich. 48640	do	Brazoria.
Eastex, Inc	P.O. Box 816 Silsbee, Tex. 77656	do	Jasper.
McDonough Bros., Inc	Fredericksburg Rd. Route 8, Box 222 San Antonio, Tex. 78228	do	Bexar.
PPG Industries, Inc	P.O. Box 4026 Corpus Christi, Tex. 78408	do	Nueces.
Round Rock Lime Co	P.O. Box 218 Round Rock, Tex. 78664	do	Hill and Williamson.
Texas Lime Co	P.O. Box 851 Cleburne, Tex. 76031	do	Johnson.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Comal and Harris.
Magnesium compounds:			
The Dow Chemical Co	Midland, Mich. 48640	do	Brazoria.
A.P. Green Refractories Co	Freeport, Tex. 77541	do	Do.
E.J. Lavino & Co	Three Penn Center Plaza Philadelphia, Pa. 19102	do	Do.
Mercury:			
The Anchor Co	309 North Third St. Alpine, Tex. 79830	Mine	Presidio.
Mica:			
Western Mica Company, division of United States Gypsum Co.	101 South Wacker Dr. Chicago, Ill. 60606	Plant	Tarrant.
Perlite:			
Filter Media, Inc	P.O. Box 19156 Houston, Tex. 77024	Expanding plant	Harris.
Perlite of Houston, Inc	P.O. Box 8386 Houston, Tex. 77004	do	Do.
Perlite Industries, Inc	P.O. Box 6216 Midland, Tex. 79701	do	Midland.
Perlite Products Co	2651 Manila Dallas, Tex. 75212	do	Dallas.
Sil-Flo Corp	3405 North Sylvania Ave. P.O. Box 7086 Ft. Worth, Tex. 76111	do	Tarrant.
Texas American Sulphur Co.	1012 Midland Savings Bldg. Midland, Tex. 79071	Mine	Presidio.
Texas Lightweight Products Co.	117 North Britain Rd. Irving, Tex. 75060	Expanding plant	Dallas.
United States Gypsum Co	101 South Wacker Dr. Chicago, Ill. 60606	do	Nolan.
Pumice:			
Rio Clay Products	P.O. Box P Rio Grande City, Tex. 78572	Mine	Starr.
Roofing granules:			
H. B. Reed & Co., Inc	8149 Kennedy Ave. Highland, Ind. 46322	Plant	Milam.
Salt:			
Diamond Shamrock Corp	300 Union Commerce Bldg. Cleveland, Ohio 44115	Brine wells	Chambers.
The Dow Chemical Co	Midland, Mich. 48640	do	Brazoria.
Montex Chemical Co	104 East 3d Monahans, Tex. 79756	do	Ward.

Table 26.—Texas: Principal producers—Continued

Commodity and company	Address	Type of activity	County
Salt—Continued			
Morton Salt Co	110 North Wacker Dr. Chicago, Ill. 60606	Underground mine and brine wells.	Van Zandt.
PPG Industries, Inc	P.O. Box 4026 Corpus Christi, Tex. 77704	Brine wells	Duval.
Phillips Petroleum Co	Bartlesville, Okla. 74003	do	Hutchison.
Texas Brine Corp	4614 Montrose Blvd. Houston, Tex. 77006	do	Harris, Jefferson, Matagorda.
United Salt Corp	do	Underground mine and brine wells.	Fort Bend and Harris.
Vulcan Materials Co	P.O. Box 1060 Denver City, Tex. 79323	Brine Wells	Yoakum.
Sand and gravel:			
Capitol Aggregates, Inc	Route 13, Box 412 San Antonio, Tex. 78209	Stationary	Guadalupe and Travis.
Dresser Minerals	Kosse, Tex. 76653	do	Limestone.
The Fordyce Co	P.O. Box 1981 San Antonio, Tex. 78206	do	Hidalgo, San Patricio, Victoria.
Ft. Worth Sand & Gravel Co.	P.O. Box 400 Arlington, Tex. 76010	do	Dallas, Denton, Tarrant.
Gifford-Hill & Co., Inc	P.O. Box 47127 Dallas, Tex. 75247	do	Brazos, Colorado, Dallas, McLenna, Tarrant, Wichita.
Horton & Horton	P.O. Box 1669 Houston, Tex. 77001	Portable and dredge	Colorado, Harris, Victoria.
Janes-Prentice, Inc	P.O. Box 2155 Austin, Tex. 78767	Stationary	Crosby.
One Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	do	Colorado, Denton, Noland.
Parker Bros. & Co., Inc	P.O. Box 107 Houston, Tex. 77001	Stationary and drege	Colorado and Harris.
Thorstenberg Materials Co.	1435 Bank of the Southwest Bldg. Houston, Tex. 75247	do	Do.
Shell:			
General Dredging Corp	P.O. Box 9294 Corpus Christi, Tex. 78408	Dredge	Nueces.
Lone Star Industries, Inc	P.O. Box 86 Houston, Tex. 77001	do	Calhoun.
Parker Bros. & Co., Inc	5303 Navigation Bldg. P.O. Box 107 Houston, Tex. 77001	do	Do.
Sodium (metallic):			
Ethyl Corp	P.O. Box 472 Pasadena, Tex. 77501	Plant	Harris.
Sodium sulfate (natural):			
Ozark-Mahoning Co	1870 South Boulder Tulsa, Okla. 74119	do	Gaines and Terry.
Stone:			
Barrett Industries	2718 S.W. Military Dr. Box 21070 San Antonio, Tex. 78221	Quarry	Bexar.
General Portland Cement Co.	2800 Republic Bank Tower Dallas, Tex. 75201	do	Dallas and Tarrant.
Gifford-Hill & Co., Inc	P.O. Box 47127 Dallas, Tex. 75247	do	Wise.
Lone Star Industries, Inc	P.O. Box 47327 Dallas, Tex. 75247	do	Burnet, Calhoun, Ellis, Hudspeth, Nolan, Wise.
Parker Bros. & Co., Inc	P.O. Box 107 Houston, Tex. 77001	do	Comal and Matagorda.
Texas Crushed Stone Co	P.O. Box 9345 Austin, Tex. 78717	do	Llano and Williamson.
Texas Industries, Inc	P.O. Box 146 Midlothian, Tex. 76065	do	Ellis and Wise.
Trinity Concrete Products Co.	P.O. Box 47524 Dallas, Tex. 75247	do	Johnson and Wise.
White's Mines, Inc	P.O. Box 500 Brownwood, Tex. 76801	do	Brown, Taylor, Uvalde.
Sulfur (native):			
Atlantic Richfield Co	P.O. Box 2819 Dallas, Tex. 75221	Frasch process	Pecos.
Duval Corp	1906 First City National Bank Bldg. Houston, Tex. 77002	do	Culberson.
Jefferson Lake Sulphur Co	P.O. Box 1185 Houston, Tex. 77001	do	Fort Bend.
Texas Gulf, Inc	200 Park Ave. New York, N.Y. 10017	do	Jefferson, Liberty, Wharton.

Table 26.—Texas: Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sulfur (byproduct):			
Amoco Production Co	P.O. Box 591 Tulsa, Okla. 74102	Secondary recovery	Andrews, Ector, Hockley, Van Zandt, Wood.
Cities Service Oil Co	P.O. Box 300 Tulsa, Okla. 74102	do	Cochran, Dawson, Gaines, Van Zandt.
Getty Oil Co	P.O. Box 8 Scroggins, Tex. 75480	do	Franklin and Freestone.
Gulf Oil Corp	P.O. Box 701 Port Arthur, Tex. 77640	do	Jefferson.
Phillips Petroleum Co	Bartlesville, Okla. 74003	do	Brazoria, Crane, Ector, Hutchinson.
Shell Oil Co	P.O. Box 2099 Houston, Tex. 77001	do	Cass, Karnes, Harris.
Warren Petroleum Corp	P.O. Box 1589 Tulsa, Okla. 74101	do	Crane, Hopkins, Karnes.
Talc and soapstone:			
Pioneer Talc Co., Inc	Chatsworth, Ga. 30705	Mine and plant	Hudspeth.
Southern Clay Products, Inc.	Box 44 Gonzales, Tex. 78629	do	Do.
Texas Talc Co	Allamoore, Tex. 79829	do	Do.
The United Sierra Div., Cyprus Mines Corp.	P.O. Box 1201 Trenton, N.J. 08606	Mine	Do.
Westex Talc Co	P.O. Box 15038 Houston, Tex. 77020	Mine and plant	Hudspeth and Culberson.
Uranium:			
Pioneer Nuclear, Inc	P.O. Box 30 Corpus Christi, Tex. 78403	Mine and mill	Karnes.
Susquehanna-Western Inc.	P.O. Box 217 Falls City, Tex. 78113	do	Live Oak and Karnes.
Tenneco, Inc	Tenneco Bldg. Houston, Tex. 77702	Mine	Karnes.
Vermiculite:			
Texas Vermiculite Co	2651 Manila Rd. Dallas, Tex. 75200	Exfoliating plant	Bexar and Dallas.
Vermiculite Products, Inc	P.O. Box 7327 Houston, Tex. 77008	do	Harris.
Volcanic ash (pumicite):			
Rio Clay Products	P.O. Box 949 Mission, Tex. 78572	Mine and plant	Starr.

The Mineral Industry of Utah

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Utah Geological and Mineralogical Survey for collecting information on all minerals.

By Gertrude N. Greenspoon [1]

Mineral production in Utah in 1972 was valued at $543 million, a 3% increase over 1971, but was 10% below the record of 1970. Increases in the mineral fuels and nonmetals groups more than offset a decrease in value in the metals group.

Total value of the 11 commodities in the metals group fell 3% below that of 1971. Only four commodities—gold, iron ore, tungsten, and uranium—registered increased value; all others decreased.

Production of mineral fuels increased 15% in total value. Asphalt and related bitumens, coal, and petroleum showed substantial gains. The value of marketed natural gas and natural gasoline declined, but value of liquefied petroleum gases increased slightly. The value of carbon dioxide was unchanged, although the volume produced increased 11%.

Increased production values were recorded for 10 commodities in the nonmetals group. Only clays, fluorspar, phosphate rock, salt, and sodium sulfate declined in value. Total value for the entire group gained 22%.

A total of 163.4 million tons of material was handled in the metals and nonmetals industries, which included 61.5 million tons of ore, 88.6 million tons of leach material, and 13.3 million tons of waste material. Underground mining operations accounted for about 1 million tons of the total tonnage handled.

Construction of N L Industries, Inc., magnesium plant at Rowley, Tooele County, on the west shore of Great Salt Lake, was nearing completion at yearend. The 45,000-ton magnesium plant is expected to begin production in early 1973 and, in addition to magnesium metal, will have capacity to produce 80,000 tons of chlorine as well as substantial quantities of sodium chloride, calcium chloride, calcium sulfate, lithium carbonate, and potash.

Construction of the first 430-megawatt unit at the Utah Power & Light Co. Huntington powerplant continued on schedule, and the plant is expected to be in operation by March 1974. In addition to the generating unit, other essential segments of the project include a 600-foot stack, water cooling towers, a coal storage facility, a switching yard, a settling pond for water, and the earthfill dam that will back up 30,000 acre-feet of water to form Electric Lake.

Employment and Injuries.—Final employment and injury data, compiled by the Bureau of Mines for 1971, with preliminary data for 1972, are shown in table 4. Information presented excludes all mineral fuels except coal and asphalt-gilsonite industries. Data on the latter operations are included in nonmetals.

Legislation and Government Programs.—The U.S. Bureau of Mines awarded a $77,200 grant to the Utah Geological and Mineralogical Survey for informational core drilling of bituminous sandstone deposits in the Uinta Basin area, eastern Utah. Virtually all preliminary work was completed in August, and completion of all work was scheduled for mid-1973.

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[1] Mineral specialist, Division of Nonferrous Metals—Mineral Supply.

Table 1.—Mineral production in Utah [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Carbon dioxide (natural) thousand cubic feet	55,178	$4	61,103	$4
Clays thousand short tons	198	1,064	[2]266	[2]790
Coal (bituminous) do	4,626	34,082	4,802	42,868
Copper (recoverable content of ores, etc.) short tons	268,451	278,989	259,507	265,735
Fluorspar do	10,947	341	2,977	84
Gem stones	NA	90	NA	95
Gold (recoverable content of ores, etc.) troy ounces	368,996	15,221	362,418	21,237
Iron ore (usable) thousand long tons, gross weight	1,681	11,886	1,788	W
Lead (recoverable content of ores, etc.) short tons	38,270	10,562	20,706	6,224
Lime thousand short tons	172	3,569	171	4,216
Manganiferous ore (5% to 35% Mn) short tons	112	W	--	--
Natural gas (marketed) million cubic feet	42,418	7,084	39,474	6,711
Natural gas liquids:				
Natural gasoline and cycle products thousand 42-gallon barrels	W	W	458	1,406
LP gases do	W	W	1,742	2,787
Petroleum (crude) do	28,680	71,886	26,570	80,773
Pumice thousand short tons	6	10	14	29
Salt do	614	5,218	660	4,955
Sand and gravel do	10,505	10,190	14,619	17,071
Silver (recoverable content of ores, etc.) thousand troy ounces	5,294	8,185	4,300	7,245
Stone thousand short tons	2,556	5,335	3,384	6,005
Uranium (recoverable content U_3O_8) thousand pounds	1,445	8,959	1,496	9,425
Vanadium short tons	226	W	188	W
Zinc (recoverable content of ores, etc.) do	25,701	8,276	21,853	7,758
Value of items that cannot be disclosed: Asphalt, beryllium, cement, clay (kaolin) (1972), gypsum, magnesium chloride (1972), magnesium compounds, molybdenum, phosphate rock, potassium salts, sodium sulfate, tungsten concentrates, vanadium, and values indicated by the symbol W	XX	49,754	XX	57,391
Total	XX	525,700	XX	542,809
Total 1967 constant dollars	XX	447,003	XX	[p]451,563

[p] Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes kaolin, included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Utah, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Beaver	$1,928	W	Copper, sand and gravel pumice.
Box Elder	W	$1,782	Stone, sand and gravel, lime, salt.
Cache	W	W	Sand and gravel, stone.
Carbon	W	W	Coal, natural gas, carbon dioxide.
Daggett	W	871	Sand and gravel, natural gas, petroleum.
Davis	875	W	Sand and gravel, stone.
Duchesne	W	W	Petroleum, natural gas, stone.
Emery	6,150	10,887	Coal, natural gas, petroleum, uranium.
Garfield	6,045	7,980	Petroleum, sand and gravel, uranium, vanadium.
Grand	2,710	4,594	Potassium salts, natural gas, uranium, petroleum, vanadium, sand and gravel.
Iron	12,049	13,195	Iron ore, sand and gravel, pumice.
Juab	884	200	Fluorspar, clays, sand and gravel, stone, beryllium concentrate.
Kane	140	W	Sand and gravel, pumice.
Millard	W	W	Pumice.
Morgan	W	W	Cement, stone, sand and gravel.
Piute	715	2	Sand and gravel, clays.
Rich	W	W	Phosphate rock, stone.
Salt Lake	318,919	305,423	Copper, gold, molybdenum, cement, silver, sand and gravel, salt, lime, stone.
San Juan	54,562	56,187	Petroleum, uranium, natural gas liquids, copper, natural gas, vanadium.
Sanpete	186	1,359	Sand and gravel, salt, clays.
Sevier	2,324	2,468	Coal, gypsum, clays, sand and gravel, salt.
Summit	5,747	6,564	Petroleum, sand and gravel, clays, natural gas, stone, coal.
Tooele	8,911	8,174	Lime, potassium salts, salt, stone, sand and gravel, clays, magnesium compounds, tungsten concentrates, magnesium chloride.
Uintah	29,228	25,733	Petroleum, asphalt, phosphate rock, natural gas, sand and gravel, natural gas liquids, stone.
Utah	10,661	18,478	Zinc, lead, stone, silver, sand and gravel, clays, lime, copper, gold.

Table 2.—Value of mineral production in Utah, by county—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Wasatch	W	$7,280	Gold, copper, lead, silver, stone, sand and gravel, zinc.
Washington	W	116	Sand and gravel, stone, pumice.
Wayne	$28	W	Sand and gravel.
Weber	5,286	2,866	Potassium salts, salt, sodium sulfate, sand and gravel, magnesium compounds, clays.
Undistributed [1]	58,346	68,657	
Total [2]	525,700	542,809	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes gem stones and sand and gravel that cannot be assigned to specific counties and values indicated by the symbol W.

[2] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Utah business activity

		1971 [r]	1972 [p]	Change, percent
Employment and labor force, annual average:				
Total labor force	thousands	449.7	473.3	+5.2
Employment	do	421.2	444.9	+5.6
Unemployment	do	28.5	28.4	−.4
Nonagricultural employment	do	371.1	395.1	+6.5
Mining	do	12.2	12.1	−.8
Construction	do	17.0	20.6	+21.2
Manufacturing	do	55.4	59.4	+7.2
Government	do	103.2	104.9	+1.6
Other nonagricultural employment [1]	do	183.3	198.1	+8.1
Personal income:				
Total	millions	$3,768	$4,217	+11.9
Per capita		$3,442	$3,745	+8.8
Construction activity:				
Total construction valuation [2]	millions	387.3	485.5	+25.4
Residential [2]	do	172.4	257.2	+49.2
Nonresidential [2]	do	115.6	125.6	+8.6
Nonbuilding [2]	do	99.2	102.7	+3.5
Highway construction contracts awarded	do	$64.0	[e] $75.0	+17.2
Cement shipments to and within the State	thousand short tons	496	653	+31.7
Farm marketing receipts	millions	$239.9	$260.0	+8.4
Mineral production value	do	$525.7	$542.8	+3.3
Production of electrical energy utilized [2]	million kilowatt hours	7,404.2	8,679.3	+17.2

[e] Estimated. [p] Preliminary. [r] Revised.

[1] Includes transportation and public utilities; wholesale and retail trade; finance, insurance, and real estate; and services.

[2] Includes 11 months.

Sources: Bureau of Economics and Business Review, University of Utah; Survey of Current Business; Employment and Earnings; Farm Income Situation; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	1,531	212	324	2,559	2	182	71.91	NA
Metal	5,157	307	1,581	12,645	4	210	16.92	2,478
Nonmetal	584	229	133	1,068	1	34	32.76	6,544
Sand and gravel	384	198	76	667	1	18	28.50	18,967
Stone	346	268	93	743	--	11	14.80	351
Total	8,002	276	2,207	17,682	8	455	26.18	NA
1972: [1]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	4,555	311	1,417	11,361	3	110	9.95	2,275
Nonmetal	460	250	116	926	1	26	29.15	7,681
Sand and gravel	360	185	67	560	2	20	39.28	23,385
Stone	330	275	91	726	3	7	13.78	24,915
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

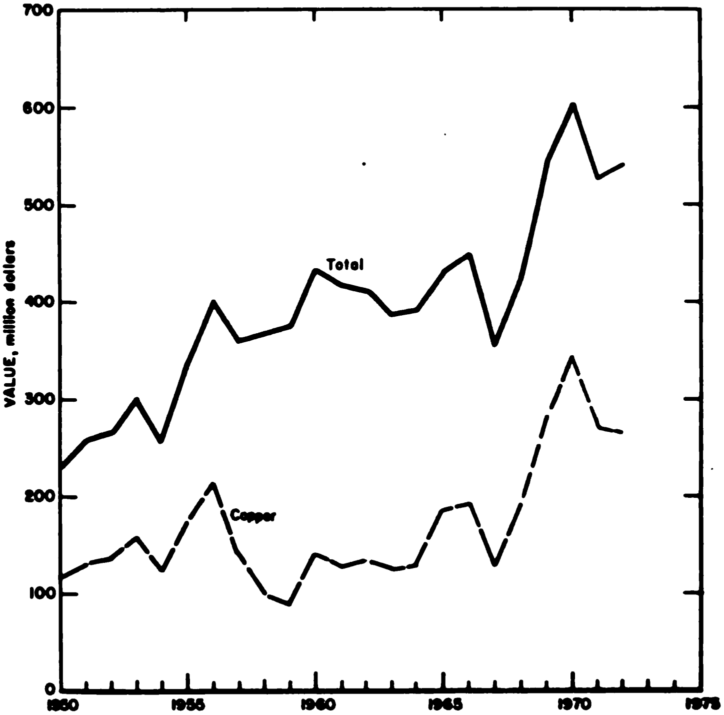

Figure 1.—Value of mine production of copper, and total value of mineral production in Utah.

REVIEW BY MINERAL COMMODITIES

METALS

Copper.—The quantity of copper produced dropped 2% and the value fell 3% in 1972. The open pit mine of Kennecott Copper Corp. at Bingham was the largest copper-producing mine in the United States. Other leading producers were the GTO mine operated by Keystone-Wallace Resources Co., the Milford mines of Essex International, Inc., and the Mayflower mine operated by Hecla Mining Co. Copper was produced from five mines in five counties.

Exploration and development continued at The Anaconda Company Carr Fork copper properties in the Bingham district. Company plans for a large-scale underground mining operation are well advanced, and if further drilling results confirm the geologic projections, development of the mine will proceed in 1973 with full output to be attained in 1977.

Gold.—Output of gold, nearly all produced as a byproduct of base metal ores, declined 2%, but the value of production rose 40% because of a higher average annual market price for gold. Four mines in three counties accounted for the total output. The open pit copper mine at Bingham was the principal gold producer. The Mayflower mine in Wasatch County was second in gold production.

Table 5.—Utah: Mine production (recoverable) of gold, silver, copper, lead, and zinc, by county

County	Mines producing [1]	Material sold or treated (short tons)	Gold		Silver	
	Lode		Troy ounces	Value	Troy ounces	Value
1970, total	17	[r]41,107,558	408,029	$14,848,175	6,029,737	$10,677,578
1971, total	14	[r]36,303,529	368,996	15,221,088	5,294,477	8,185,260
1972:						
Beaver	1	338,393	--	--	--	--
Salt Lake	1	35,152,081	[2]314,499	[2]18,429,640	[2]3,679,580	[2]6,200,094
San Juan	1	266,449	--	--	--	--
Utah	2	191,474	W	W	W	W
Wasatch	1	114,604	47,914	2,807,761	620,024	1,044,740
Total	6	36,063,001	362,413	21,237,401	4,299,604	7,244,834

County	Copper		Lead		Zinc		Total value
	Short tons	Value	Short tons	Value	Short tons	Value	
1970, total	295,738	$341,281,734	45,377	$14,174,712	34,688	$10,627,695	$391,609,894
1971, total	263,451	273,988,832	38,270	10,562,422	25,701	8,275,804	316,233,406
1972:							
Beaver	2,952	3,022,680	--	--	--	--	3,022,680
Salt Lake	251,440	257,475,019	--	--	--	--	280,365,886
San Juan	3,691	3,779,961	--	--	--	--	3,779,961
Utah	51	51,822	17,175	5,162,819	21,268	7,548,633	14,502,141
Wasatch	1,373	1,405,945	3,531	1,061,526	590	209,308	6,529,280
Total	259,507	265,735,427	20,706	6,224,345	21,858	7,757,941	308,199,948

[r] Revised. W Withheld to avoid disclosing individual company confidential data.

[1] Operations at old mill or miscellaneous cleanups are not counted as producing mines, nor are various uranium mines counted from which byproducts were recovered.

[2] Salt Lake and Utah Counties combined to avoid disclosing individual company confidential data.

Table 6.—Utah: Mine production of gold, silver, copper, lead, and zinc in 1972, by class of ore or other source material, in terms of recoverable metal

Source	Number of mines [1]	Material sold or treated (short tons)	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode ore:							
Dry gold-silver	1	143,167	689	6,763	505	--	--
Dry silver	1	355	69	7,525	--	--	--
Total	2	143,522	758	14,288	505	--	--
Copper	3	35,556,542	313,412	2,654,690	210,614	--	--
Copper-lead	1	114,604	47,914	620,024	1,373	3,531	589
Lead-zinc	1	191,119	329	1,010,602	51	17,175	21,264
Total	5	35,862,265	361,655	4,285,316	212,038	20,706	21,853
Other lode material:							
Copper precipitates	1	57,214	--	--	46,964	--	--
Grand total	6	36,063,001	362,413	4,299,604	259,507	20,706	21,853

[1] Detail will not add to total because some mines produce more than one class of material.

Table 7.—Utah: Mine production of gold, silver, copper, lead, and zinc in 1972, by type of material processed and method of recovery, in terms of recoverable metal

Type of material processed and method of recovery	Gold (troy ounces)	Silver (troy ounces)	Copper (short tons)	Lead (short tons)	Zinc (short tons)
Lode:					
Leaching	--	--	6,643	--	--
Smelting of concentrates	361,655	4,096,591	205,395	17,276	19,144
Direct smelting of—					
Ore	758	203,013	505	3,430	2,709
Copper precipitates	--	--	46,964	--	--
Total	362,413	4,299,604	259,507	20,706	21,853

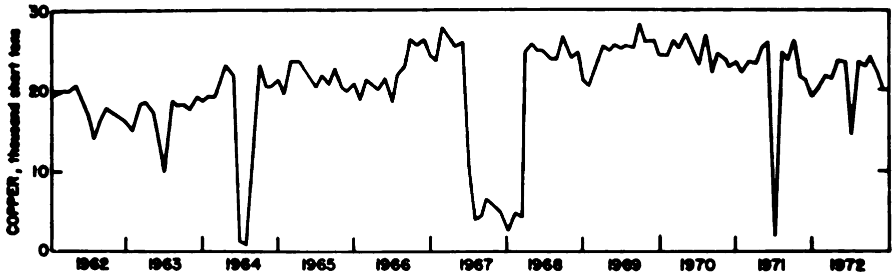

Figure 2.– Mine production of copper in Utah, by months in terms of recoverable metals.

Iron Ore.—Three open pit mines, all in Iron County, accounted for total production in 1972. The producing mines were the Comstock of CF&I Steel Corp., the Desert Mound of United States Steel Corp., and the Iron Springs of Utah International, Inc. Total output rose 6%.

Ore and concentrates shipped during 1972 contained an average of 52.5% iron. Most of the ore and concentrates shipped were utilized by the iron and steel industry, and a small quantity was used in making paint.

Lead.—Two mines, one each in Utah and Wasatch Counties, accounted for the total output in 1972. Production dropped 46% and 41%, respectively, in quantity and value.

The Mayflower mine in Wasatch County, leased by Hecla Mining Co. from New Park Resources, Inc., was closed on December 31. Hecla had held the lease on the mine since 1961.

Magnesium Compounds.—Production of magnesium compounds was reported by Kaiser Aluminum & Chemical Corp., Bonneville plant, and N L Industries, Inc., in Tooele County, and by Great Salt Lake Minerals & Chemicals Corp. in Weber County.

Molybdenum.—Molybdenum production in Utah, 24% less than in 1971, was recovered as a byproduct from the concentration of copper ore mined by Kennecott Copper Corp. at Bingham.

Selenium.—All of the selenium output was recovered as a byproduct from the Kennecott Copper Corp. electrolytic refinery at Garfield. Production rose 29%.

Silver.—Production of silver in Utah declined 19% in quantity and 11% in value in 1972. Output was reported from four mines in three counties. The leading producer was the Kennecott Copper Corp. Utah Copper mine at Bingham, followed by the Burgin mine in Utah County.

Uranium.—Although fewer uranium mines operated during 1972—54 compared with 59 in 1971—output rose 4% and value rose 5%. Value was calculated on a basis of $5.80 per pound recoverable content (U_3O_8) marketed through the U.S. Atomic Energy Commission and $6.30 per pound for commercial sales. The average grade of the ores mined was 0.20% U_3O_8 compared with 0.19% in 1971.

Production of ore began October 1 at the Rio Algom Corp. Humeca uranium mine and mill southeast of Moab. A contract with Duke Power Co., Charlotte, N.C., calls for delivery of 3 million pounds of U_3O_8 over a 6-year period beginning in 1972.

The Atlas Corp. announced discovery of uranium-vanadium deposits in the Sage Plains area, about 18 miles northeast of Monticello, San Juan County. The Atlas mill at Moab, currently processing uranium ores from several properties, is approximately 50 miles northwest of the new discovery.

Vanadium.—The quantity and value of vanadium recovered from Utah ores declined 17% in 1972. Vanadium-bearing ores from three counties were processed at Mills in Colorado.

Zinc.—Zinc production reported from two mines in two counties decreased 15% in quantity and 6% in value. Output was reported from the Burgin mine of Kennecott Copper Corp. in Utah County, and the Mayflower mine of Hecla Mining Co. in Wasatch County.

MINERAL FUELS

Asphalt and Related Bitumens.—Output from two gilsonite-producing companies dropped 15%, but value rose 12% as a result of a higher unit value.

Carbon Dioxide.—The value of production of carbon dioxide was unchanged from 1971, but output rose 11%. All production continued to come from the one-well Farnham Dome field, Carbon County.

Coal (Bituminous).—Coal production from properties in four counties increased 4% in quantity; a 26% increase in value was caused by an increase in the average price from $7.37 to $8.93 per ton. Carbon and Emery Counties accounted for 96% of the total output.

Two new mines were brought into production by the Peabody Coal Co. in 1972, and two new mines will begin production in early 1973. The company's capacity will be increased to nearly 82 million tons annually. Coal supply agreements were completed with Panhandle Eastern Pipe Line Co., Houston, Tex., whereby Peabody will produce coal for delivery to two coal gasification plants. One plant, in eastern Wyoming, will require 17 million tons of coal annually; the other, in southern Illinois, will need 7.5 million tons per year.

Table 8.—Utah: Coal (bituminous) production in 1972, by county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total [1]	
Carbon	11	1	12	3,012	32	3,044	$30,821
Emery	8	--	8	1,569	--	1,569	10,821
Sevier	1	--	1	184	--	184	W
Summit	1	--	1	6	--	6	W
Total	21	1	22	4,770	32	4,802	42,868

W Withheld to avoid disclosing individual company confidential data; included in "Total."

[1] Data may not add to total shown because of independent rounding.

Utah Power & Light Co. is now receiving coal by unit train at the Gadshy plant, Salt Lake City. The coal is mined at the recently acquired Deseret mine in Emery County, 40 miles south of Price. Extensive repairs were made to the 100,000-kilowatt unit at the plant to insure 98% recovery of the particulate matter by electrostatic precipitation. The 75,000-kilowatt unit at the plant will be shutdown to permit upgrading the precipitators also. Pilot plant operations were underway to remove SO_2 from plant emissions.

Natural Gas.—Marketed natural gas declined 7% from the 42.4 billion cubic feet marketed in 1971, and the value of marketed production fell 5%. The average wellhead price, however, rose from 16.7 cents per thousand cubic feet to 17 cents per thousand. The State Division of Oil and Gas Conservation[2] reported production of 74.2 billion cubic feet, of which 30.7 billion cubic feet was injected into reservoirs for storage. San Juan County was the largest producer of marketed natural gas, followed by Uintah and Grand Counties.

Natural gas reserves estimated by the American Petroleum Institute (API) and the American Gas Association, Inc. (AGA) totaled 1.022 trillion cubic feet. Reserves increased 40 billion cubic feet; new fields added 27.1 billion cubic feet and revisions and extensions added 58.8 billion cubic feet.

Thirteen gas wells were completed in 1972—seven in Uintah County, three in Daggett County, two in Grand County, and one in Wasatch County. Gary Operating Co. completed its gas processing plant in the Bluebell field, Duchesne County. Capacity is 20 million cubic feet per day. Construction was begun by Shell Oil Co. on a gas processing plant in the Altamont field, Duchesne County. Initial capacity of 40 million cubic feet per day is scheduled for operation in 1973.

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[2] Utah Department of Natural Resources, Division of Oil and Gas Conservation. Monthly Oil and Gas Production Report, December 1972.

Natural Gas Liquids.—Production of natural gas liquids decreased in quantity and in value. According to estimates by API and AGA, reserves of gas liquids totaled 34 million barrels at yearend, unchanged from 1971.

Petroleum.—The 12% increase in crude petroleum production in 1972 resulted principally from the high rate of activity on the Uinta Basin's new Tertiary trend. San Juan County continued to rank first in the State, but its share of the total output fell to 43% from 49% in 1971. Duchesne County rose from third to second place and supplied 22% of the total. Uintah and Garfield Counties were third and fourth with 20% and 10%, respectively, of the total output.

The Greater Aneth field, San Juan County, continued as the principal producing area with 7.9 million barrels of oil. The Greater Red Wash area, Uintah County, comprising the Wonsits Valley, Red Wash Unit, and Walker Hollow fields, was second with 4.9 million barrels. The Bluebell field, Duchesne County, ranked third with 2.9 million barrels. The Upper Valley field, Garfield County, was fourth, producing 2.6 million barrels, and the Lisbon field, San Juan County, and Altamont field, Duchesne County, were fifth and sixth, respectively, with nearly 2.5 million barrels each.

Proved crude oil reserves in the State at yearend 1972 were 244.4 million barrels, an increase of 78.6 million barrels. In addition, 35.8 million barrels are considered available by fluid injection. New fields added 1.1 million barrels, and revisions and extensions added 103.8 million barrels.

Six oil refineries in the State processed 41.2 million barrels of crude oil. Utah fields provided 14.2 million barrels; 27.0 million barrels was received from other

Table 9.—Utah: Crude oil production, by county

(Thousand 42-gallon barrels)

County	1971	1972	Principal fields in 1972, in order of production
Daggett	6	7	Clay Basin.
Duchesne	2,984	5,893	Bluebell, Altamont, Cedar Rim, Starvation.
Emery	5	8	Grassy Trail, Ferron.
Garfield	1,948	2,614	Upper Valley.
Grand	116	97	Salt Wash, Left Hand Canyon, Long Canyon.
San Juan	11,485	11,846	Greater Aneth Area, Lisbon.
Summit	841	1,166	Bridger Lake.
Uintah	6,244	5,444	Red Wash Area, Ashley Valley.
Wasatch	1	--	
Total	23,630	26,570	

Source: Utah Oil & Gas Conservation Commission.

Table 10.—Utah: Oil and gas well drilling completions in 1972, by county

County	Proved field wells[1]			Exploratory			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Wells	Footage
Daggett	--	3	--	--	--	1	4	31,082
Duchesne	39	--	1	17	--	6	63	712,984
Emery	--	--	1	--	--	2	3	16,429
Garfield	4	--	2	--	--	8	14	72,093
Grand	--	2	4	5	--	9	20	65,761
Kane	--	--	--	--	--	1	1	3,092
San Juan	5	--	1	--	--	20	26	152,962
Sanpete	--	--	--	--	--	1	1	12,332
Sevier	--	--	--	--	--	1	1	6,377
Summit	--	--	--	--	--	1	1	10,527
Uintah	3	6	3	--	1	8	21	179,002
Wasatch	--	--	--	--	1	--	1	12,583
Washington	--	--	--	--	--	2	2	4,196
Wayne	--	--	--	--	--	2	2	3,908
Total	51	11	12	22	2	62	160	1,283,328

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

States. Colorado and Wyoming were the principal sources of out-of-State crude oil, providing 15.7 million and 11.1 million barrels, respectively. Out-of-State shipments of Utah crude oil totaled 14.6 million barrels, of which 11.3 million went to California and 2.8 million went to Texas.

Drilling activity increased sharply in 1972—73 more wells than in 1971, and the largest number of wells since 1965. More than half (86) produced—73 oil and 13 gas. The drilling occurred in fourteen counties but Duchesne County was by far the most successful. The new Tertiary trend in the deeper part of the Uinta Basin was the principal point of interest. Six of the Tertiary discoveries were in Duchesne County where Brinkerhoff Drilling Co. Inc. completed the Blue Bench and Starvation fields. Other discoveries included two by Shell Oil Co., one each by Sun Oil Co. and Gulf Oil Corp., and one gas well by Texaco, Inc., in Wasatch County.

NONMETALS

Barite.—Crude barite was not produced in Utah in 1972. However, barite mined in California and Nevada was processed for well drilling mud by Custom Milling & Supply Co. at Salt Lake City.

Cement.—Output of portland cement rose 12% in quantity and 14% in value. Increases were also recorded in masonry cement. The entire output was produced by Ideal Cement Co., Div. of Ideal Basic Industries, Inc., and Portland Cement Co. of Utah. Portland and masonry cement consumed in the State totaled 652,200 and 1,110 short tons, respectively. Eighty-two percent of the portland cement was purchased by ready-mix concrete companies, 7% by concrete product manufacturers, 6% by building material dealers, and 5% by contractors and other users. Raw materials used in making portland cement included limestone and cement rock, sand, gypsum, iron-bearing materials, and sandstone.

Clays.—Although output of clays rose 34%, value fell 26%. Eighteen operations in eight counties contributed to total production. The major producing companies were Utelite Corp., Entrada Industries, Interpace Corp., and Western States Mining, Inc. The materials listed as clays included shale, common clay, bentonite, fire clay, fuller's earth, and halloysite (a kaolin group mineral). Most of the clays were used as expanded material in making lightweight aggregates, in manufacturing building brick, and as catalysts in oil refining.

A clay mineral (halloysite) deposit was discovered in the Tintic district, Utah County, on property controlled by Western States Mining, Inc. The new deposit is a short distance northeast of the Dragon mine, which has been operated for several years by Filtrol Corp.

Gypsum.—Georgia-Pacific Corp., Gypsum Division, and United States Gypsum Co. were the only companies reporting gypsum production. Both companies operated open pit mines and plants near Sigurd, Sevier County. The tonnage produced increased 6% and the value of crude gypsum rose 14%. Most of the output was calcined. Small quantities were sold for use as a portland cement retarder and for agricultural requirements.

Lime.—The Flintkote Co., Utah-Marblehead Lime Co., Kennecott Copper Corp., Utah-Idaho Sugar Co., and Lakeside Lime, Inc., produced lime in Box Elder, Salt Lake, Tooele, and Utah Counties. Output was about the same as last year and was 14% below the 1966 record. The lime was used for refractories, copper ore concentration, soil stabilization, and other uses. The lime was consumed in Utah, California, Colorado, and other States. Total consumption of lime in Utah was 140,000 tons.

Perlite.—Two plants, Acme Lite Wate Products, Inc., Salt Lake City, and Georgia-Pacific Corp., Gypsum Division, at Sigurd, expanded perlite from out-of-State sources for use as a plaster aggregate and in building.

Phosphate Rock.—The Stauffer Chemical Co., with mines in Rich and Uintah Counties, was the only producer of phosphate rock. Phosphate rock from the Cherokee mine was processed in the company plant at Leefe, Wyo. Output was 9% below 1971 and value decreased 5%.

Potash.—Production of potash salts was reported by Texas Gulf, Inc., near Moab, Grand County; Kaiser Aluminum & Chemical Corp., Bonneville, Ltd., Division, at Wendover, Tooele County; and Great Salt Lake Minerals & Chemicals Corp., Weber County. Output increased 77% in quantity and 35% in value.

Pumice.—Five mines in five counties

produced pumice and related volcanic materials, most of which was used in road construction. Total tonnage produced and value increased substantially.

Salt.—Salt, from eight operations in six counties, increased 7% in quantity, but fell 5% in value. Evaporated salt was produced by six companies at ponds in four counties, and one mine each in Sanpete and Sevier Counties accounted for all rock salt production. The salt was sold for use in many industries, including the chemical and animal feed processing industries, but most of the output was sold to government agencies for road salt.

Sand and Gravel.—Although fewer sand and gravel mines operated during 1972—93 operations compared with 109 in 1971—output rose 39% and value gained 68%. The average value of sand and gravel produced increased from $0.97 per ton to $1.17 per ton. Only Salt Lake County reported output from more than 10 operations—19 compared with 25 in 1971. Sand and gravel continued to lead the nonmetallic group in total value of commodity production.

Stone.—Production of stone from 32 quarries rose 32% in quantity and 13% in value. Three counties—Utah, Box Elder, and Morgan—accounted for 63% of the total output. Principal producing companies were United States Steel Corp., Southern Pacific Railroad Co., Ideal Cement Co. Div. of Ideal Basic Industries, Inc., and Portland Cement Co. of Utah.

Vermiculite.—No vermiculite production was reported in 1972, but out-of-State material was exfoliated by Vermiculite-Intermountain Inc. in Salt Lake City. The product was sold and used principally as plaster aggregate and as block and loose-fill insulation. Other uses included concrete aggregate, pipe covering, and soil conditioning.

Table 11.—Utah: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Box Elder	4	635	445	4	637	472
Cache	11	647	620	7	501	590
Davis	6	1,198	875	7	1,756	1,472
Duchesne	2	W	W	2	108	123
Grand	2	W	W	3	29	W
Iron	2	W	W	5	812	W
Juab	1	47	31	1	47	31
Kane	1	W	31	2	W	W
Morgan	1	21	36	1	W	W
Piute	--	51	29	1	1	2
Salt Lake	25	3,286	3,014	19	4,610	4,441
Uintah	4	W	W	4	272	W
Utah	8	813	644	6	1,102	1,564
Washington	6	36	72	2	W	W
Wayne	1	103	28	1	W	W
Weber	9	611	657	3	225	225
Undistributed [1]	[r]26	3,063	3,707	25	4,521	3,153
Total [2]	109	10,505	10,190	93	14,619	17,071

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Beaver, Carbon (1971), Daggett (1972), Emery (1971), Garfield, Rich (1971), Sanpete, Sevier, Summit, Tooele, and Wasatch Counties and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 12.—Utah: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	1,553	1,514	1,853	2,341
Fill	177	89	114	78
Paving	581	591	379	348
Other uses [1]	22	59	301	357
Total [2]	2,334	2,254	2,647	3,125
Gravel:				
Building	1,729	1,471	2,314	2,512
Fill	255	119	459	251
Paving	4,069	4,928	5,231	7,259
Other uses [3]	64	51	1,000	842
Total [2]	6,117	6,569	9,006	10,864
Government-and-contractor operations:				
Sand:				
Building	3	7	--	--
Fill	1	1	84	82
Paving	103	112	4	1
Other uses	36	1	12	6
Total	143	121	100	89
Gravel:				
Building	50	35	--	--
Fill	787	269	528	211
Paving	1,033	904	2,261	2,705
Other uses	41	38	78	78
Total [2]	1,911	1,246	2,867	2,993
Total sand and gravel [2]	10,505	10,190	14,619	17,071

[1] Includes blast, engine, fill (ground) (1971), foundry, and other sands.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes miscellaneous, railroad ballast, and other gravel.

Table 13.—Utah: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972			Kind of stone produced in 1972
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Box Elder	5	W	W	2	W	W	Other stone.
Cache	3	289	417	3	W	W	Limestone, sandstone.
Daggett	1	W	W	--	--	--	
Davis	--	--	--	2	W	W	Quartzite, other stone.
Iron	3	W	W	--	--	--	
Juab	1	W	W	1	3	11	Quartzite.
Morgan	1	W	W	2	W	W	Limestone, sandstone.
Rich	--	--	--	1	1	1	Other stone.
Salt Lake	4	W	W	3	W	W	Limestone, quartzite.
Summit	2	W	W	3	W	W	Sandstone, other stone.
Tooele	3	W	970	6	W	729	Marble, limestone, dolomite.
Uintah	--	--	--	1	W	W	Limestone.
Utah	5	W	W	4	W	W	Limestone, dolomite.
Wasatch	1	W	W	3	W	W	Sandstone, limestone.
Washington	3	W	W	1	W	W	Sandstone.
Undistributed	--	2,266	3,947	--	3,381	5,264	
Total [1]	32	2,556	5,335	32	3,384	6,005	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."
[1] Data may not add to totals shown because of independent rounding.

Table 14.—Utah: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone:				
Rough blocks	(1)	8	W	W
Cut stone thousand cubic feet	4	35	--	--
Total [2] short tons	4	208	1	33
Crushed and broken stone:				
Dense graded road base stone	210	246	382	318
Lime and cement manufacture	(3)	(3)	948	1,670
Other uses [4]	2,343	4,881	2,054	3,984
Total [5]	2,552	5,127	3,383	5,972
Grand total	2,556	5,335	3,384	6,005

W Withheld to avoid disclosing individual company confidential data; included in "Total."

[1] Less than ½ unit.

[2] Includes data for rough flagging, sawed stone, and house stone veneer; and uses not specified, 1971 only.

[3] Included in "Other uses."

[4] Includes stone used in agricultural lime, poultry grit, concrete aggregate, bituminous aggregate, riprap and jetty stone, terrazzo, ferrosilicon, flux stone, refractory stone, mine dusting, surface treatment aggregates, roofing aggregates, and other uses not specified. 1972 data also include whiting, other filler, and fill. 1971 data also include stone used in drain fields.

[5] Data may not add to totals shown because of independent rounding.

Table 15.—Utah: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone total [1]	4	208	1	33
Crushed and broken:				
Limestone	1,112	2,239	[2] 2,326	[2] 4,414
Dolomite	W	W	--	--
Marble	W	W	W	W
Sandstone	W	W	122	123
Quartzite	W	121	30	55
Other stone	706	863	W	W
Undistributed	785	1,903	907	1,380
Crushed total [3]	2,552	5,127	3,383	5,972
Grand total [3]	2,556	5,335	3,384	6,005

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes sandstone, marble (1972). 1971 data also include quartzite and slate.

[2] Data combined to avoid disclosing confidential data.

[3] Data may not add to totals shown because of independent rounding.

Table 16.—Principal producers

Commodity and company	Address	Type of activity	County
Asphalt and related bitumens:			
American Gilsonite Co	Suite 1150, Kennecott Bldg. Salt Lake City, Utah 84110	Underground mine Refinery	Uintah. Mesa.
Beryllium: Brush Wellman, Inc	67 W. 2950 S. Salt Lake City, Utah 84115	Open pit mine Chemical processing plant.	Juab. Millard.
Carbon dioxide (natural):			
Equity Oil Co	806 American Oil Bldg. Salt Lake City, Utah 84101	Well and plant, Farnham Dome field.	Carbon.
Cement:			
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.[1]	420 Ideal Cement Bldg. Denver, Colo. 80202	Wet process, 2-rotary-kiln plant.	Morgan.
Portland Cement Co. of Utah	Box 1469 Salt Lake City, Utah 84110	Wet process	Salt Lake.

See footnote at end of table.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Clays:			
Entrada Industries, Interstate Brick Div.	Box 517 West Jordan, Utah 84084	Mine and plant	Summit, Sevier, Tooele, Utah.
Filtrol Corp	8250 E. Washington Blvd. Los Angeles, Calif. 90023	Open pit-underground mine.	Juab.
Interpace Corp	2901 Los Feliz Blvd. Los Angeles, Calif. 90039	Open pit mine	Sevier, Utah, Weber.
Utelite Corp	R.F.D. Coalville, Utah 84017	Open pit mine and expanding plant.	Summit.
Western Clay & Metals Co	1200 S. Atlantic Blvd. Alhambra, Calif. 91803	2 open pit mines	Sevier.
Western States Mining, Inc	418 S. 7th E. Riverton, Wyo. 82501	Mine and plant	Utah.
Coal (bituminous):			
Kaiser Steel Corp	Sunnyside Coal Mines Sunnyside, Utah 84539	3 underground mines and cleaning plant.	Carbon.
The North American Coal Corp	12800 Shaker Blvd. Cleveland, Ohio 44120	Underground mine and cleaning, thermal drying, and oil treatment plant.	Do.
United States Fuel Co	1910 University Club Bldg. Salt Lake City, Utah 84111	Underground mine	Carbon and Emery.
		Cleaning, crushing and oil treatment plant.	Carbon.
United States Steel Corp., Western District.	Box 807 Dragerton, Utah 84520	Underground mine	Carbon and Emery.
		Cleaning, thermal drying, and crushing plant.	Carbon.
Copper:			
Hecla Mining Co	Box 320 Wallace, Idaho 83873	*See* Gold	Wasatch.
Kennecott Copper Corp., Utah Copper Division.	Box 11299 Salt Lake City, Utah 84111	Open pit mine, crusher, 2 flotation mills, precipitation plant, smelter, and electrolytic refinery.	Salt Lake.
Fluorspar:			
Spor Bros	Box 276 Delta, Utah 84624	Open pit and underground mines.	Juab.
Willden Fluorspar Co	Box 536 Delta, Utah 84624	Underground mine	Do.
Gold:			
Hecla Mining Co	Box 320 Wallace, Idaho 83873	Underground mine and flotation mill.	Wasatch.
Kennecott Copper Corp., Utah Copper Division	Box 11299 Salt Lake City, Utah 84111	*See* Copper	Salt Lake.
Gypsum:			
Georgia-Pacific Corp., Gypsum Division.	P.O. Box 311 Portland, Oreg. 97204	Open pit mine and calcining plant.	Sevier.
United States Gypsum Co	101 S. Wacker Dr. Chicago, Ill. 60606	----do	Do.
Iron ore:			
CF&I Steel Corp	Box 1920 Pueblo, Colo. 80201	3 open pit mines	Iron.
United States Steel Corp., Western Ore Operations.	Lander, Wyo. 82520	Open pit mine	Do.
Utah International, Inc	Box 649 Cedar City, Utah 84720	2 open pit mines, mobile crushing and screening plant, and beneficiation plant.	Do.
Lead:			
Hecla Mining Co	Box 320 Wallace, Idaho 83873	*See* Gold	Wasatch.
Kennecott Copper Corp., Tintic Division.	Box 250 Eureka, Utah 84628	*See* Zinc	Utah.
Lime:			
The Flintkote Co., U.S. Lime Division.[1]	2244 Beverly Blvd. Los Angeles, Calif. 90057	2-shaft-kiln plant	Do.
Kennecott Copper Corp	Box 11299 Salt Lake City, Utah 84111	Lime kiln	Salt Lake.
Utah Marblehead Lime Co.[1]	300 W. Washington St. Chicago, Ill. 60606	Rotary-kiln plant	Tooele.
Magnesium chloride:			
Great Salt Lake Minerals & Chemicals Co	765 N. 10500 W. Ogden, Utah 84402	Solar evaporation	Weber.
Kaiser Aluminum & Chemical Corp., Bonneville, Ltd., Division.	300 Lakeside Dr. Oakland, Calif. 94612	----do	Salt Lake.

See footnotes at end of table.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Molybdenum: Kennecott Copper Corp., Utah Copper Division.	Box 11299 Salt Lake City, Utah 84111	*See* Copper	Salt Lake.
Natural gas and petroleum:			
American Oil Co	Box 898 Salt Lake City, Utah 84110	Refinery	Do.
Atlantic Richfield Co	717 Fifth Ave. New York, N.Y. 10022	Crude oil wells, Boundary Butte field.	San Juan.
Belco Petroleum Corp	630 Third Ave. New York, N.Y. 10017	Crude oil wells, White River field.	Uintah.
		Natural gas wells, Chapita Wells field.	Do.
Chevron Oil Co., Western Division.	Box 599, 1700 Broadway Denver, Colo. 80201	Crude oil wells and gas processing plant, Red Wash field.	Do.
		Crude oil wells, Bluebell field.	Duchesne.
		Natural gas wells, Powder Springs and Horseshoe Bend fields.	Uintah.
		Refinery	Salt Lake.
Gulf Oil Corp	Gulf Bldg. Pittsburgh, Pa. 15230	Crude oil and natural gas wells, Wonsits Valley field.	Uintah.
		Indian Ridge field	Duchesne.
Humble Oil & Refining Co., Central Division.	2000 Classen Center N. Oklahoma City, Okla. 73106	Natural gas wells, Saleratus field.	Do.
		Crude oil wells, Walker Hollow field.	Uintah.
Husky Oil Co	Box 380 Cody, Wyo. 82414	Refinery	Salt Lake.
Monsanto Polymers & Petrochemicals Co., Hydrocarbons Division.	800 N. Lindbergh Blvd. St. Louis, Mo. 63166	Crude oil wells, McElmo Mesa field.	San Juan.
Mt. Fuel Supply	180 E. First S. St. Salt Lake City, Utah 84111	Natural gas wells	Daggett, Uintah, Emery.
Phillips Petroleum Co	431 S. 3d E. Salt Lake City, Utah 84111	Crude oil wells, Ratherford field.	San Juan.
		Bridger Lake field	Summit.
		Refinery	Davis.
The Superior Oil Co	Box 1521 Houston, Tex. 77001	Crude oil wells, McElmo Creek field.	San Juan.
Texaco Inc	Box 2100 Denver, Colo. 80201	Crude oil wells, Aneth, Ismay, and Flodine Park fields.	Do.
		Natural gas wells, Fence Canyon field.	Uintah.
Union Oil Company of California, Western Region.	Box 7600 Los Angeles, Calif. 90054	Crude oil wells and gas processing plant, Lisbon field.	San Juan.
Phosphate rock: Stauffer Chemical Co.	636 California St. San Francisco, Calif. 94119	Open pit-underground mine.	Rich.
		Open pit mine and beneficiation plant.	Uintah.
Potassium salts:			
Great Salt Lake Minerals & Chemicals Corp.	Box 1190 Ogden, Utah 84402	Brine processing plant.	Weber.
Kaiser Aluminum & Chemical Corp.	300 Lakeside Dr. Oakland, Calif. 94604	do	Tooele.
Texas Gulf, Inc	200 Park Ave. New York, N.Y. 10017	Underground mine and flotation refinery.	Grand.
Pumice: Thompson Block Co	620 N. 400 W. Cedar City, Utah 84720	Open pit mine and crushing and screening plant.	Beaver.
		do	Iron.
Salt:			
Great Salt Lake Minerals & Chemicals Corp.	Box 1190 Ogden, Utah 84402	Solar evaporation	Weber.
Hardy Salt Co	P.O. Drawer 449 St. Louis, Mo. 63166	do	Salt Lake.
Morton Salt Co., a division of Morton International, Inc.	110 N. Wacker Dr. Chicago, Ill. 60606	Lake brine processing plant.	Do.
Solar Salt Co	270 Crossroad Square Salt Lake City, Utah 84115	do	Tooele.

See footnotes at end of table.

Table 16.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel:			
W. W. Clyde & Co.	Box 232 Springville, Utah 84663	Portable plant	Various.
Construction Materials Corp., Savage Bros., Inc., Division.	R.F.D. 4, Box 611 American Fork, Utah 84003	Pit and plant	Davis.
Cox Construction Co., Inc.	270 N. First E. Manti, Utah 84642	Portable plant	Sanpete.
Dan R. Fogle Sand & Gravel Products.	850 Hartwell Ave. Salt Lake City, Utah 84115	Pit and 3 plants	Salt Lake.
Gibbons & Reed Co., Concrete Products Co. Division.	41 W. Central Ave. Murray, Utah 84107	Pit and plant	Davis.
		do	Salt Lake.
		do	Weber.
Geneva Rock Products Co.	1565 W. 400 N., Box 528 Orem, Utah 84057	3 stationary plants	Utah.
Nevada Rock & Sand Co.	Box 2775 Huntridge Station Las Vegas, Nev. 89104	Portable plant	Various.
Utah Sand & Gravel Products Corp.	Box 537 Salt Lake City, Utah 84110	3 pits and plants	Salt Lake.
Younch A. Sons Construction Co.	1135 S. West Temples Salt Lake City, Utah 84104	Portable plant	Summit.
Selenium: Kennecott Copper Corp., Utah Copper Division.	Box 11299 Salt Lake City, Utah 84111	*See* Copper	Do.
Silver:			
Deer Trail Mines & Arundel Mining Co.	1834 S. Woodside Dr. Salt Lake City, Utah 84172	*See* Zinc	Piute.
Hecla Mining Co.	Box 320 Wallace, Idaho 83873	*See* Gold	Wasatch.
Kennecott Copper Corp., Tintic Division.	Box 250 Eureka, Utah 84628	*See* Zinc	Utah.
Kennecott Copper Corp., Utah Copper Division.	Box 11299 Salt Lake City, Utah 84111	*See* Copper	Salt Lake.
Kennecott Copper Corp. (Ben Dixon & Christie, lessee).	do	Underground mine	Do.
Stone:			
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Quarry	Morgan.
Portland Cement Company of Utah.	Box 1469 Salt Lake City, Utah 84110	Quarry and plant	Salt Lake.
Southern Pacific Railroad Co.	65 Market St. San Francisco, Calif. 94105	Quarry	Box Elder.
United States Steel Corp., Western Ore Operations.	Lander, Wyo. 82520	Quarry and plant	Utah.
Utah Marblehead Lime Co.	300 W. Washington St. Chicago, Ill. 60606	do	Tooele.
Uranium:			
Atlas Corp., Atlas Minerals Division.	Box 1207 Moab, Utah 84532	14 underground mines	San Juan.
Homestake Mining Co.	Box 563 Moab, Utah 84532	Underground mine	Do.
Lake Washburn Mining Co.	720-26 Road Grand Junction, Colo. 81501	2 underground mines	Do.
Vanadium: *See* Uranium			
Zinc:			
Hecla Mining Co.	Box 320 Wallace, Idaho 83873	*See* Gold	Wasatch.
Kennecott Copper Corp., Tintic Division.	Box 250 Eureka, Utah 84628	2 underground mines	Utah.

[1] Also stone.

The Mineral Industry of Vermont

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U. S. Department of the Interior, and the Geological Survey of Vermont, for collecting information on all minerals except fuels.

By Frank B. Fulkerson [1]

Mineral production in Vermont in 1972 was valued at $34.9 million, a decrease of $1.2 million (3%) compared with that in 1971. The value for stone, the principal mineral commodity produced in Vermont, dropped $1.8 million (6%). The volume

Table 1.—Mineral production in Vermont [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Peat .... thousand short tons..	W	W	(2)	$1
Sand and gravel .... do....	3,761	$3,518	3,302	3,214
Stone .... do....	[r] 2,496	[r] 27,940	3,300	26,170
Talc .... short tons..	W	W	180,239	1,326
Value of items that cannot be disclosed:				
Other nonmetallics and values indicated by the symbol W	XX	4,631	XX	4,157
Total	XX	[r] 36,089	XX	34,868
Total 1967 constant dollars	XX	30,686	XX	[p] 29,007

[p] Preliminary. [r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Less than ½ unit.

Table 2.—Value of mineral production in Vermont, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Addison	W	$291	Stone, sand and gravel.
Bennington	W	W	Sand and gravel, stone.
Caledonia	W	W	Stone, sand and gravel.
Chittenden	$1,476	W	Do.
Essex	W	W	Sand and gravel, stone.
Franklin	W	W	Stone, sand and gravel.
Lamoille	W	W	Talc, sand and gravel, stone.
Orange	W	W	Stone, sand and gravel.
Orleans	W	W	Asbestos, sand and gravel, stone.
Rutland	W	W	Stone, sand and gravel.
Washington	W	W	Do.
Windham	W	W	Stone, talc, sand and gravel.
Windsor	2,224	1,054	Talc, sand and gravel, stone, peat.
Undistributed [2]	[r] 32,390	33,524	
Total [3]	[r] 36,089	34,868	

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Grand Isle County is not listed because no production was reported.

[2] Includes value of gem stones and values indicated by the symbol W.

[3] Data may not add to totals shown because of independent rounding.

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[1] Industrial economist, Division of Nonmetallic Minerals—Mineral Supply.

Table 3.—Indicators of Vermont business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force..........thousands..	193.0	196.8	+2.0
Unemployment..........do....	12.8	12.8	--
Employment:			
Manufacturing..........do....	37.9	38.4	+1.3
Durable goods..........do....	24.9	24.9	--
Nondurable goods..........do....	13.0	13.5	+3.8
Nonmanufacturing..........do....	110.5	113.9	+2.7
Mining and quarrying..........do....	.9	.9	--
Payroll-average weekly earnings:			
Manufacturing..........	$128.54	$136.12	+5.9
Personal income:			
Total..........millions..	$1,650	$1,786	+8.2
Per capita..........	$3,638	$3,865	+6.2
Construction activity:			
Number of housing units authorized..........	1,850	1,939	+4.8
Valuation of nonresidential building construction..........millions..	$10.2	$13.1	+28.4
Portland cement shipments to and within Vermont thousand short tons..	107	154	+43.9
Mineral production value..........thousands..	r $36.1	$34.9	−3.3

p Preliminary. r Revised.

Sources: Survey of Current Business; Employment and Earnings; Construction Review; Area Trends in Employment and Unemployment; U.S. Bureau of Mines; and New England Economic Indicators.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Nonmetal..........	336	273	92	743	--	24	32.32	8,694
Sand and gravel..........	291	165	48	457	--	7	15.32	260
Stone..........	1,264	245	309	2,502	1	60	24.38	3,178
Total..........	1,891	237	449	[1] 3,701	1	91	24.85	3,925
1972: [2]								
Nonmetal..........	325	274	90	721	--	12	16.64	523
Sand and gravel..........	100	193	20	192	--	10	52.19	699
Stone..........	930	265	247	1,999	1	47	24.01	3,873
Total [1]..........	1,360	262	356	2,912	1	69	24.04	2,834

[1] Data may not add to totals shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data on file as of July 1, 1973 and are preliminary.

of stone was up nearly one-third, but average value per ton declined sharply. Sand and gravel production went down $300,000 (9%). Production value for other minerals, mainly asbestos and talc, went up $853,000 (18%).

Several mining companies were investigating the copper potential of Orange and Windsor Counties and other areas in eastern Vermont. Exploration leasing activity was reported in Corinth, Vershire, Topsham, Strafford, Sharon, West Fairlee, Pomfret, and elsewhere. No copper has been produced in Vermont since the last producing mine closed in 1958.

The Vermont Yankee Nuclear Power Corp. plant at Vernon went into commercial operation. The 540,000-kilowatt facility is Vermont's first atomic powerplant.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Asbestos.—Production of chrysotile asbestos by GAF Corp., Building & Industrial Floor Products Div., from its Lowell mine, Orleans County, declined 8% in tonnage but increased 12% in value. The output was shipped out of State for the manufacture of asbestos-cement roofing and siding, industrial board, and corrugated sheets. In 1972, Vermont ranked second in the Nation in asbestos production.

Gem Stones.—Specimens of semiprecious gem stones were collected at various locations within the State.

Mica, Reconstituted.—At its Rutland plant, Samica Corp. used specially delaminated scrap mica in manufacturing reconstituted sheet mica.

Sand and Gravel.—Sand and gravel production totaled 3.3 million tons valued at $3.2 million. Output declined 12% in tonnage and 9% in value, compared with that of 1971. Value per ton was $0.97 ($0.94 in 1971). About 2.5 million tons or 76% of the total was produced by 22 commercial operations at an average value of $1.22 per ton; 0.8 million tons or 24% was by 14 Government-and-contractor operations with an average value of $0.24 per ton. All counties except Grand Isle produced sand and gravel. Leading counties were Chittenden, Essex, and Rutland. Leading commercial producers were Caledonia Sand & Gravel Co. Inc., and Lawrence Sangravco, Inc.

Construction by the Vermont Department of Highways was concentrated on Interstate Route 91 in the Bradford and Barton areas. At the end of 1972 almost three-fourths of Vermont's 321-mile interstate system was in use. The Highway Department purchased sand and gravel from commercial producers and contracted for production as part of its construction and maintenance projects. Its own crews produced sand for ice control and gravel for paving.

Stone.—The value of stone production declined from $27.9 million to $26.2 million. Average value per ton for dimension stone decreased from $136.13 to $113.48, and average value per ton for crushed stone declined from $4.27 to $3.10. Tonnage of dimension stone increased 10%. Quantity of crushed stone advanced 33%.

Table 5.—Vermont: Sand and gravel production by Government-and-contractor operations, by county

(Thousand short tons)

County	1971	1972
Addison	15	38
Bennington	23	9
Caledonia	342	10
Chittenden	17	37
Essex	9	16
Franklin	61	70
Lamoille	8	3
Orange	23	231
Orleans	181	79
Rutland	32	132
Washington	22	50
Windham	2	42
Windsor	32	109
Total[1]	768	825

[1] Data may not add to totals shown because of independent rounding.

By kinds of stone, marble and granite led in value, followed by limestone, miscellaneous stone, slate, dolomite, and quartzite. In terms of value, leading counties were Rutland, Washington, Caledonia and Orange. Leading producers were Vermont Marble Co.; Rock of Ages Corp.; Wells-Lamson Quarry Co., Inc.; and the State Highway Department. Seventy-nine quarries were active.

Vermont Marble Co., the Nation's largest marble producer, completed construction of a new tunnel at its Imperial quarry at Danby for quicker and easier loading of rough marble blocks onto trucks for shipment to the company gang saw mill in West Rutland.[2] The new tunnel will increase operating efficiency at the quarry through reduced costs in materials handling. Previously the marble blocks, which weigh up to 62 tons, were brought by rail to a shaft and raised by derrick to the surface where trucks were loaded. The company also installed a 40-ton electric-drive fork lift inside the quarry. The company, which has a finishing plant at Proctor, has operated the Imperial quarry since 1905. It has supplied finished marble for such well known buildings as the Supreme Court building and the Thomas Jefferson Memorial in Washington, D.C.

Vermont Marble Co. also operated an automated ground products plant at Florence to process white marble. The plant features a central control console and two electronically controlled optical sorting machines to separate white marble from darker pieces. Specialty products included landscaping and terrazzo chips, marble sands, and fillers.

White Pigment Corp., an affiliate of Vermont Marble Co., processed crushed limestone at two plants, one at New Haven and one at Florence, and produced fillers for paint, rubber, plastics, and other industrial products. Production capacity of the Florence plant was being expanded at a cost of $900,000.

Rock of Ages Corp., the largest quarrier and manufacturer of granite memorial products in the United States, operated four quarries and a large manufacturing plant in Barre.

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[2] Building Stone News. Vermont Marble Completes Tunnel for Quarrying. April 1972, p. 5.

Swanton Lime Works, Inc., crushed limestone in Franklin County for use as construction aggregate, agricultural lime, papermill stone, and terrazzo.

Dimension slate was produced by 11 companies in Rutland County. Output was flagging slate, standard roofing slate, and mill stock for structural and sanitary applications.

Talc.—Eastern Magnesia Talc Co., Vermont Talc Co., and Windsor Minerals, Inc., operated four talc mines in Lamoille, Windham, and Windsor Counties, respectively. The talc was ground for use in toilet preparations, plastics, rubber, paper, paint, insecticides, asphalt filler, refractories, foundry facings, and for export.

MINERAL FUELS

Peat.—Reed-sedge peat for the purpose of soil improvement was produced from a bog in Windsor County. The material was sold both in bulk and packaged form.

Table 6.—Principal producers

Commodity and company	Address	Type of activity	County
Asbestos:			
GAF Corporation, Bldg. & Industrial Floor Products Division.[1]	140 West 51st St. New York, N.Y. 10020	Pit	Orleans.
Peat:			
Kirks Green Mountain Peat	P.O. Box 456 Woodstock, Vt. 05091	Bog	Windsor.
Sand and gravel:			
Caledonia Sand & Gravel Co. Inc.	Box 428 St. Johnsbury, Vt. 05819	Pit	Washington.
Calkins Construction, Inc	Danville, Vt. 05828	Pit	Orleans.
J. P. Carrara & Sons, Inc	N. Clarendon, Vt. 05759	Pit	Rutland.
William E. Dailey, Jr	N. Bennington, Vt. 05257	Pit	Bennington.
S. T. Griswold, Inc	P.O. Box 8 Williston, Vt. 05495	Pit	Chittenden.
Hinesburg Sand & Gravel	Hinesburg, Vt. 05461	Pit	Do.
Kelly Construction Co	700 N. Main St. Barre, Vt. 05641	Pit	Washington.
Lawrence Sangravco, Inc	138 Portland St. Johnsbury, Vt. 05819	Pit	Essex.
Twin States Sand & Gravel Co	P.O. Box 267 West Lebanon, N.H. 03784	Pit	Windsor.
Vermont Sand & Gravel Corp	Box 429 Bellows Falls, Vt. 05101	Pit	Rutland.
Stone:			
Granite (dimension):			
Rock of Ages Corp	Barre, Vt. 05641	Quarry	Orange, Washington, Windsor.
Wells-Lamson Quarry Co., Inc.	102 N. Main St. Barre, Vt. 05641	do	Washington.
Granite (crushed):			
Wells-Lamson Quarry Co., Inc.	Framingham, Mass. 01701	do	Do.
Limestone (crushed and broken):			
L. A. Demers Crushed Rock Co.	Upper Main St. Winooski, Vt. 05404	do	Chittenden.
Swanton Lime Works, Inc	Swanton, Vt. 05488	do	Franklin.
Vermarco Ground Products Division of Vermont Marble Co.	W. Rutland, Vt. 05777	do	Rutland.
Marble (dimension):			
Vermont Marble Co.[2]	Proctor, Vt. 05765	do	Rutland and Windsor.
Slate (dimension):			
John G. Hadeka	25 College St. Poultney, Vt. 05764	do	Rutland.
Hilltop Slate Co	Middle Granville, N.Y. 12849	do	Do.
Rising & Nelson Slate Co., Inc.	West Pawlet, Vt. 05775	do	Do.
Somich Brothers	Granville, N.Y. 12832	do	Do.
Taran Brothers, Inc	No. Poultney, Vt. 05764	do	Do.
Tatko Brothers Slate Co	Middle Granville, N.Y. 12849	do	Do.
Vermont Structural Slate Co., Inc.	Prospect St. Fair Haven, Vt. 05743	do	Do.
Talc:			
Eastern Magnesia Talc Co	Johnston, Vt. 05656	Underground	Lamoille.
Vermont Talc Co	Chester, Vt. 05143	do	Windham.
Windsor Minerals, Inc	P.O. Box 680 Windsor, Vt. 05089	do	Windsor.

[1] Also miscellaneous stone.

[2] Also crushed marble.

The Mineral Industry of Virginia

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Virginia Division of Mineral Resources for collecting information on all minerals except fuels.

By Charles E. Vannoy [1]

Paced by record-breaking values of coal, sand and gravel, and stone, the 1972 value of mineral production in Virginia rose to a new high of $490 million, 27% greater than in 1971. This was the 10th consecutive year that mineral values have increased. Over half of the mineral commodities produced gained in quantity of output, and three-fifths gained in value. Of the total value of mineral production in the Commonwealth, 71% was contributed by fuels (66% in 1971), 28% by nonmetals (32% in 1971), and 1% by metals (2% in 1971).

Trends and Developments.—Vermiculite deposits have been located in Louisa County during drilling operations conducted by W. R. Grace & Co. The firm has test drilling rights on more than 3,250 acres in the Green Springs area, and has been prospecting in the county for about 3 years. No decision has been made to mine vermiculite, but the company believes there are sufficient quantities to justify a mining operation. If mining is done, it will be by open pit methods.

Commonwealth Natural Gas Corp. announced plans to construct a $6 million synthetic natural gas plant near Chesapeake. The plant will produce 30 million cubic feet per day of high-quality pipeline gas. Liquid hydrocarbons for feedstock will be imported from Western hemisphere sources, mainly Venezuela. The plant is scheduled for completion in June 1973.

Virginia Electric and Power Co.

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[1] Mining engineer, Division of Fossil Fuels—Mineral Supply.

Table 1.—Mineral production in Virginia [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays .... thousand short tons..	1,710	$1,800	1,634	$1,783
Coal (bituminous) .... do....	30,628	254,870	34,028	344,061
Gem stones	NA	12	NA	13
Lead (recoverable content of ores, etc.).... short tons..	3,386	934	3,441	1,039
Lime .... thousand short tons..	759	11,049	758	11,734
Natural gas .... million cubic feet..	2,619	822	2,787	892
Petroleum (crude) .... thousand 42-gallon barrels..	1	W	(2)	(2)
Sand and gravel .... thousand short tons..	12,796	20,201	14,085	21,696
Soapstone .... short tons..	3,704	8	W	W
Stone .... do....	34,643	63,482	39,987	74,090
Zinc (recoverable content of ores, etc.) .... do....	16,829	5,419	16,789	5,960
Value of items that cannot be disclosed: Aplite, cement, feldspar (1971), gypsum, kyanite, salt, titanium concentrates (1971), and values indicated by symbol W..	XX	26,564	XX	28,523
Total	XX	385,161	XX	489,791
Total 1967 constant dollar	XX	327,502	XX	p 407,457

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Less than ½ unit.

Table 2.—Value of mineral production in Virginia, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Accomack	$1	$11	Sand and gravel.
Albemarle	W	W	Stone, sand and gravel.
Alleghany	W	W	Stone.
Amherst	W	W	Stone, sand and gravel.
Appomattox	W	W	Stone.
Augusta	870	W	Stone, sand and gravel.
Bedford	W	--	
Bland	W	W	Stone.
Botetourt	W	W	Cement, stone, clays.
Brunswick	W	W	Stone, clays.
Buchanan	105,925	159,815	Coal, natural gas, sand and gravel.
Buckingham	W	W	Kyanite, stone.
Campbell	W	W	Stone.
Caroline	269	W	Sand and gravel.
Carroll	8	--	
Charles City	W	W	Sand and gravel.
Chesapeake (City)	W	W	Do.
Chesterfield	5,183	7,623	Sand and gravel, stone, clays.
Clarke	W	W	Stone.
Craig	W	W	Sand and gravel.
Culpeper	W	W	Stone.
Dickenson	W	W	Coal, natural gas.
Dinwiddie	W	W	Stone.
Fairfax	W	W	Stone, sand and gravel.
Fauquier	378	W	Stone.
Floyd	--	17	Do.
Franklin	W	W	Talc.
Frederick	6,293	6,885	Stone, lime, sand and gravel, clays.
Giles	W	W	Lime, stone.
Gloucester	--	W	Sand and gravel.
Goochland	W	2,945	Stone.
Grayson	W	401	Stone, sand and gravel.
Greensville	W	W	Stone, clays.
Halifax	W	W	Stone, sand and gravel.
Hampton (City)	W	W	Sand and gravel, stone.
Hanover	W	W	Stone, aplite, sand and gravel.
Henrico	3,211	2,828	Sand and gravel, stone.
Henry	W	W	Stone.
Highland	56	180	Do.
Isle of Wight	W	W	Sand and gravel, lime.
King George	W	W	Sand and gravel.
King William	W	W	Do.
Lee	6,743	8,242	Coal, stone, petroleum.
Loudoun	W	W	Stone, sand and gravel.
Louisa	W	W	Stone.
Madison	W	--	
Mecklenburg	W	--	
Middlesex	W	W	Sand and gravel.
Montgomery	W	W	Stone, clays.
Nansemond	W	W	Clays, stone.
Nelson	W	W	Stone, aplite.
New Kent	W	W	Sand and gravel.
Newport News (City)	W	W	Do.
Norfolk (City)	5,340	5,313	Cement.
Northampton	(2)	W	Sand and gravel.
Northumberland	--	W	Do.
Nottaway	W	W	Stone.
Orange	W	W	Clays.
Page	W	W	Stone, sand and gravel.
Pittsylvania	W	W	Do.
Prince Edward	W	W	Kyanite, stone.
Prince George	758	W	Sand and gravel.
Prince William	W	W	Stone, clays.
Pulaski	W	W	Do.
Rappahannock	W	W	Stone, sand and gravel.
Richmond	14	W	Sand and gravel.
Richmond (City)	--	W	Clays.
Roanoke	W	W	Stone, clays.
Rockbridge	892	687	Stone, sand and gravel, clays.
Rockingham	W	W	Stone, sand and gravel.
Russell	24,688	28,803	Coal, stone, clays, natural gas.
Scott	1,207	W	Stone, coal.
Shenandoah	W	W	Lime, stone.
Smyth	2,575	434	Stone, sand and gravel, clays.
Spotsylvania	W	W	Sand and gravel, stone.
Stafford	W	141	Sand and gravel.
Surry	--	W	Do.
Tazewell	14,302	18,959	Coal, stone, natural gas, clays, lime.

See footnotes at end of table.

Table 2.—Value of mineral production in Virginia, by county [1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Virginia Beach (City)	$886	$969	Sand and gravel.
Warren	W	W	Cement, stone, sand and gravel.
Washington	2,694	W	Stone, gypsum.
Westmoreland	--	W	Sand and gravel.
Wise	58,138	74,508	Coal, stone, natural gas.
Wythe	8,074	8,477	Zinc, stone, lead.
York	8	28	Sand and gravel.
Undistributed [3]	136,697	163,033	
Total [4]	385,161	489,791	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] The following counties and cities are not listed because no production was reported: Amelia, Arlington, Bath, Charlotte, Cumberland, Essex, Fluvanna, Green, James City, King and Queen, Lancaster, Lunenburg, Lynchburg (City), Matthews, Patrick, Powhatan, Southampton, and Sussex.

[2] Less than ½ unit.

[3] Includes sand and gravel and stone (1971) that cannot be assigned to specific counties, gem stones, natural gas (1971), and values indicated by symbol W.

[4] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of Virginia business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force thousands	1,890.3	1,947.9	+3.0
Unemployment do	61.9	54.4	−12.1
Employment:			
Manufacturing do	362.0	383.3	+5.9
Mining do	15.0	16.0	+6.7
Construction do	98.4	105.8	+7.5
Transportation and public utilities do	97.8	100.4	+2.7
Wholesale and retail trade do	312.8	325.2	+4.0
Finance, insurance, and real estate do	71.0	75.8	+6.8
Services do	229.1	238.4	+4.1
Government [1] do	313.9	324.5	+3.4
Personal income:			
Total millions	$18,400	$20,289	+10.3
Per capita	$3,899	$4,258	+9.2
Construction activity:			
Value of nonresidential construction millions	$470.8	$486.1	+3.2
New housing units authorized	69,237	81,604	+17.9
Portland cement shipments to and within Virginia thousand short tons	1,887	2,107	+11.7
Farm marketing receipts millions	$614.9	$679.1	+10.4
Mineral production value do	$385.2	$489.8	+27.2

[p] Preliminary.

[1] Excludes Federal Government workers in the Virginia portion of the Washington, D.C. metropolitan area.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; and U.S. Bureau of Mines.

(VEPCO) announced plans to install an 845,000-kilowatt generating unit at its Possum Point power station in Prince William County. The new unit, like the four existing units at Possum Point, will be oil fired. VEPCO also announced that it will expend $8.3 million for construction of a new fuel oil terminal and the conversion of an existing power station from coal to oil. The $5 million terminal will be erected adjacent to the Yorktown Power Station and will be a joint effort with the American Oil Co. (AMOCO). AMOCO operates a refinery next to the station. The terminal will be owned by VEPCO, but will be built and operated by AMOCO.

A new corporation, Titanium Minerals, Inc., has been formed to mine titanium in Nelson County. Estimates of available ore in the area are about 2 million tons of ilmenite and 400,000 tons of rutile.

For the first time the Commonwealth of Virginia's 40,595 square miles are completely covered by detailed topographic mapping. These 805 maps, scale 1:24,000, are the culmination of a 10-year program under a $9 million cooperative effort shared equally by the Commonwealth of Virginia and the U.S. Geological Survey. To keep the maps up to date, each portion of the State will be examined for revisions each 5 years by inspection of aerial photographs.

Studies of the geology and mineral resources of Virginia include an open file report issued in August 1972 by the Virginia Division of Mineral Resources of an aeromagnetic survey that covers approximately 7,890 square miles in central and western Virginia. The survey joins four previous aeromagnetic surveys that were flown and released in 1962, 1965, 1970, and 1971. The contour maps are available for reference use in the Division library at Charlottesville. The Division also published reports on the geology of two Virginia quandrangles[2] and a bibliography of the State's geology and mineral resources.[3]

A directory of the Virginia mineral industry is issued annually by the Virginia Division of Mineral Resources.[4] The 1972 edition lists 224 companies and individuals, exclusive of coal producers, on record as of March 15, 1972. The listing includes portable crushing plants, some captive and intermittent operations, and some processors of out-of-State or imported materials. The names of producers and processors are arranged by county or city under the appropriate raw material or commodity. The locations of the various operations are given with respect to a nearby city or town. An alphabetical listing of companies and individuals is also provided.

Employment and Injuries.—Statistics of employment and injuries in the mineral industry, exclusive of the petroleum industry, are presented in table 4.

The 1972 annual report of the Virginia Department of Labor and Industry reported 15 fatalities in the coal industry, the same number as reported in 1971. The cause of the 15 fatalities were as follows: seven by falls of face or roof, three by haulage, three by machinery, one by drowning, and one by electricity. The fatality rate per million tons of coal produced was 0.44, compared with the alltime low of 0.32 attained in 1968. The number of workers directly involved in coal mine operations was 11,569, an increase of 1,350 people over 1971. Of this total, the production workers numbered 11,071 and office workers 498.

Legislation and Government Programs.—The 1972 General Assembly tightened the State's laws on strip mining, the first changes made since the strip mining law was enacted in 1966. One of the provisions of the law authorizes fees to be collected in the amount of $82,000 during the first

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[2] Coch, N. K. Geology of the Newport News South and Bowers Hill Quadrangles, Virginia. Va. Div. Miner. Res. (Charlottesville, Va.), RI 28, 1972, 26 pp.
Johnson, G. H. Geology of the Yorktown, Poquoson West, and Poquoson East Quadrangles, Virginia. Va. Div. Miner. Res. (Charlottesville, Va.), RI 30, 1972, 57 pp.

[3] Hoffer, F. B. Bibliography of Virginia Geology and Mineral Resources, 1950-1959. Va. Div. Miner. Res. (Charlottesville, Va.), IC 19, 1972, 103 pp.

[4] Levan, D. C. Directory of the Mineral Industry in Virginia, Va. Div. Miner. Res. (Charlottesville, Va.), 1972, 46 pp.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	10,806	208	2,251	17,953	16	1,117	63.11	NA
Metal	278	248	69	551	1	40	74.48	11,832
Nonmetal	737	271	200	1,606	--	20	12.45	4,126
Sand and gravel	528	250	132	1,165	--	21	18.03	746
Stone	3,542	262	929	7,782	3	213	27.76	3,931
Total	15,891	225	[1] 3,580	29,057	20	1,411	49.25	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	250	255	64	512	--	41	80.13	3,588
Nonmetal	530	270	143	1,186	1	31	26.99	5,420
Sand and gravel	575	225	130	1,212	--	16	13.20	192
Stone	2,655	277	735	6,238	4	133	21.96	4,314
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.
[1] Data does not add to total shown because of independent rounding.
[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973, and are preliminary.

year for the reclamation of "orphaned land."

The Virginia Division of Mines and Quarries announced the receipt of a grant from the Federal Bureau of Mines under the provisions of Section 503 of PL 91-173. The sum of $77,838 was granted for support of a project entitled "Training and Education of Coal Miners, Operators and Agents in Coal Mine Health and Safety."

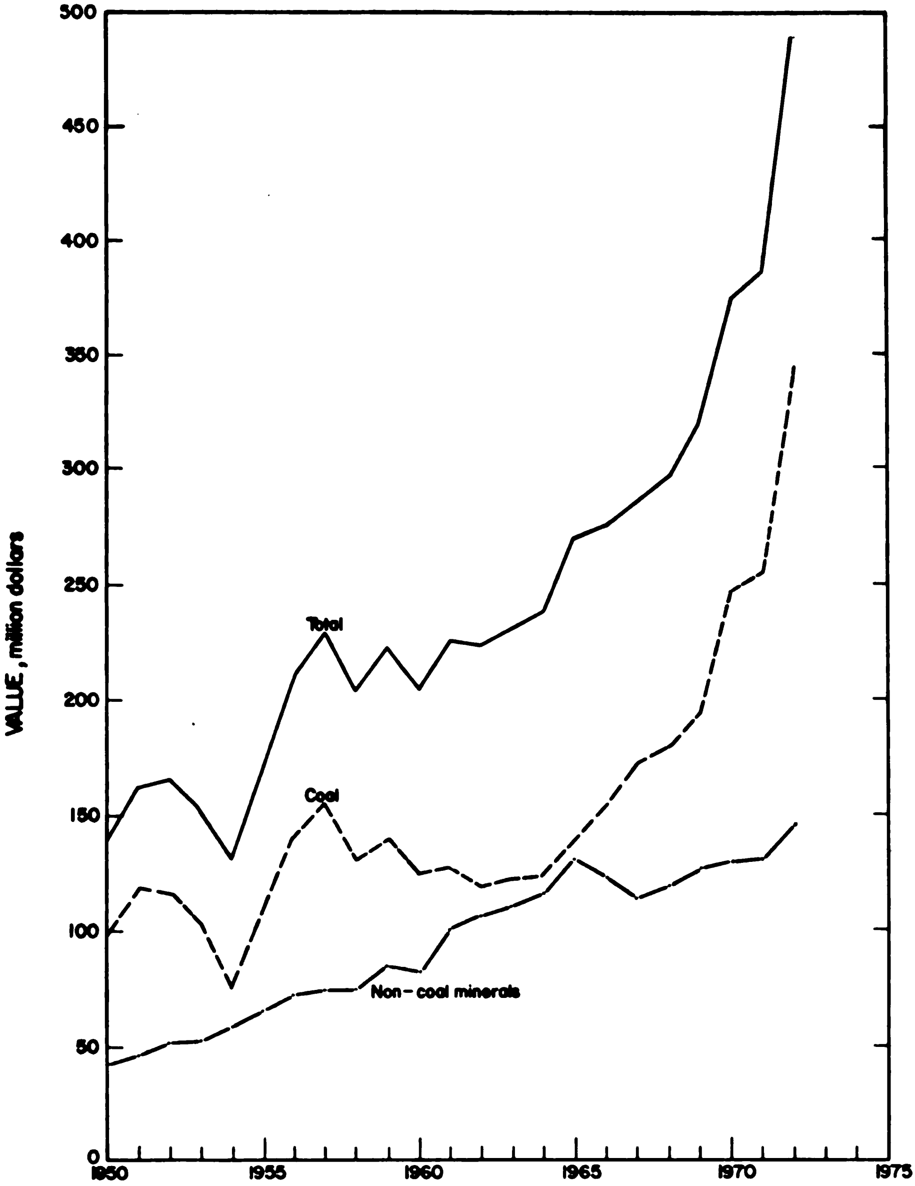

Figure 1.—Value of non-coal minerals, value of coal, and total value of all mineral production in Virginia.

The Division of Mines has been engaged in training and educating coal miners for several years, and this grant will support and enlarge the present program.

Virginia Polytechnic Institute was granted $73,800 by the Federal Bureau of Mines. The grant is to continue research on a new chemical stabilization or "gluing" technique to prevent coal mine roofs from collapsing. Various polymers and resins are being tried as a glue or cement for keeping unstable overhead shales of coal mines in place. This grant follows a previous award of $102,000 for this project.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Coal, the State's leading mineral commodity in terms of output value, accounted for 70% of the value of Virginia's mineral production in 1972. Mine output increased 11% and the value increased 35%. An average increase of $1.79 per ton to $10.11 was responsible for making 1972 the peak value year. Production data include coal produced from deposits within Virginia, whether the mine opening is or is not inside the State boundary, and exclude operations producing less than 1,000 tons per year. Consequently, production data published by the Federal Bureau of Mines differ somewhat from data published by the State.

Both high- and low-volatile bituminous coals were produced for electric power generation, coke manufacture, industrial and domestic heating, other industrial uses, and export. Coalbeds mined included the Blair, Clintwood, Eagle, Hagy, High Splint, Imboden, Jawbone, Jewell, Kelly, Lyons, Parsons, Pocahontas No. 3, Splash Dam, Taggart, Tiller, Upper and Lower Banner, and Widow Kennedy.

Of the total coal produced, 71% was from underground mines, 23% from strip mines, and 6% from auger mines. For the first time, the number of surface mines (strip and auger) exceeded the number of underground mines. Coal production was reported from seven southwestern counties. Three counties accounted for 84% of the total output. These counties were Buchanan (39%), Wise (27%), and Dickenson (18%). Buchanan County was the leading producer in both underground and auger mining; Wise County led in strip mine output.

The total underground output from 327 mines was 23.99 million tons compared with 21.63 million tons produced by 355 mines in 1971. The average value received was $11.56 per ton, an increase of $2.10 over the $9.46-per-ton average value in 1971.

A total of 314 mobile loading machines produced 11.48 million tons or 48% of the underground output. Continuous miners numbered 161 and produced 11.27 million tons or 47%. Eight plow-type longwall installations produced 1.22 million tons or 5%, and the tonnage produced by hand loading and other methods was negligible.

Strip mines produced 7.94 million tons having an average value of $6.70 per ton compared with $5.58 per ton for the 7.17 million tons produced in 1971. The number of strip mines increased to 244 compared with 212 in 1971.

Auger mine output increased 15% to 2.10 million tons. The average value was $6.46 per ton compared with 1.83 million tons at $5.66 per ton in 1971. The number of auger mines increased by 19, to a total of 122.

Equipment used in the 366 surface mines (244 strip and 122 auger) included 280 power shovels and draglines, 258 bulldozers, 148 front-end loaders, 28 motorgraders, 132 augers, and 28 carryall scrapers.

Thirty-one mechanical cleaning plants received 25.94 million tons of raw coal from which 8.18 million tons of refuse was removed and 17.76 million tons of saleable coal (52% of the State's total production) were recovered. The coal cleaning methods employed were tables, 39%; dense medium, 38%; froth flotation, 13%; jigs, 9%; and all other methods, 1%.

Twenty thermal drying units in 10 cleaning plants processed 4.50 million tons, or 25% of the mechanically cleaned coal.

Transportation of coal to market was 32.96 million tons by rail (including 3.30 by unit-train) and 1.05 million tons by truck.

Table 5.—Virginia: Bituminous coal production, by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total[1]	
Buchanan	215	48	47	310	11,001	1,356	845	13,202	$158,961
Dickenson	34	37	16	87	4,460	1,542	233	6,235	60,595
Lee	20	17	10	47	683	220	132	1,036	7,594
Russell	4	12	10	26	1,817	778	117	2,712	27,078
Scott	2	--	--	2	11	--	--	11	94
Tazewell	13	11	5	29	1,314	456	20	1,790	15,621
Wise	39	119	34	192	4,706	3,582	752	9,041	74,118
Total[1]	327	244	122	693	23,993	7,935	2,100	34,028	$344,061

[1] Data may not add to totals shown because of independent rounding.

Coke.—Coal was converted to coke at two plants, one plant in Buchanan County used Mitchell-type ovens, the other plant in Wise County used beehive ovens. No byproducts were recovered at either plant. Total coke production decreased 6% and average coke yield was 64.8%.

Petroleum and Natural Gas.—Natural gas production data in table 1 are reported to the Bureau of Mines by pipeline companies and are comparable with other State chapter data. The production of natural gas for commercial use was 2,787 million cubic feet, 6% greater than that of 1971. According to the Virginia Department of Labor and Industry, Division of Mines and Quarries, the total amount of natural gas produced in five southwestern counties was Buchanan (1,084 million cubic feet); Dickenson (400 million cubic feet); Tazewell (1,035 million cubic feet); Wise (7 million cubic feet); and Russell (5 million cubic feet). Reserves of natural gas were 35,921 million cubic feet, as reported by the American Gas Association.[5] This was 4,846 million cubic feet more than in 1971.

Development and exploratory drilling by the Columbia Gas Transmission Corp. (Columbia Gas) continued during 1972 with the drilling of 20 wells having a combined footage of 93,159 feet. Three additional wells were drilled by other operators bringing the total footage drilled during 1972 to 101,355 feet. Thirteen of the wells drilled by Columbia Gas had a combined total openflow of 25,172 million cubic feet. Five test wells were drilled to the Devonian shale by Columbia Gas. These wells are waiting on fracture treatment or testing after treatment. Most of the production was in Berea sandstone with minor amounts from the Maxon and Big Lime. Two shallow test wells in Charles City County were plugged and abandoned.

During 1972 production of crude petroleum in Virginia totaled 97 barrels from one well in the Rose Hill field in Lee County. There was no drilling or workover activity in 1972, although a few wells are awaiting stimulation attempts. A refinery was operated by AMOCO at Yorktown, York County. Operating capacity was 52,900 barrels per day.

NONMETALS

Aplite.—Production of aplite increased 6% in 1972, but the value decreased 20% below that of 1971. The ground aplite, chiefly used in glassmaking, with a minor amount used as brick flux, was produced by The Feldspar Corp. in Hanover County and International Minerals and Chemical Corp. in Nelson County.

Cement.—Shipments of portland cement remained stable but value increased 19%, and masonry cement shipments increased 10% in quantity and 16% in value. Consumption of cement in the State totaled 2,106,936 tons of portland and 229,965 tons of masonry. Types of portland cement shipped included type I and II (general use and moderate heat); type III (high-early-strength); white, and others. Disposition of portland cement by type of customer was ready-mix concrete companies (64%); concrete product manufacturers (13%); building material dealers (10%); and contractors and other users (13%).

Three cement plants were active in 1972. One plant in Botetourt County produced both types of cement, whereas one plant in Warren County produced masonry cement only. The third plant, operated by Lone Star Industries, Inc., in the City of Norfolk, discontinued kiln operations in April but continued to operate grinding mills on imported clinker. Raw material used in making cement included limestone, marl, clay and shale, sand, gypsum, and iron-bearing materials.

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[5] Oil and Gas Journal. U.S. Reserves Skid Again. V. 71, No. 13, Mar. 26, 1973, p. 53.

Clays.—Clay production decreased 4% and value fell 1% compared with that of 1971. The average value per short ton rose to $1.09. The principal use was in manufacturing face brick. Other major uses were lightweight aggregate and cement plants. Minor uses were for clay dummies (shot-hole tampers) and miscellaneous products.

Clay production was reported by 11 companies operating 21 mines in 14 counties and one independent city. In order of output and value the chief producing counties were Botetourt, Orange, Russell, Prince William, and Chesterfield. The foregoing five counties accounted for 73% of the State output and output value. Four firms, Webster Brick Co., Inc., Lone Star Industries, Inc., General Shale Products Corp., and Clinchfield Coal Co., accounted for 71% of the output and 72% of the output value.

Table 6.—Virginia: Clays sold or used by producers

(Thousand short tons and thousand dollars)

Year	Quantity	Value
1968	1,462	1,714
1969	1,677	1,504
1970	1,638	1,672
1971	1,710	1,800
1972	1,634	1,788

Gem Stones.—Mineral collectors and hobbyists collected a variety of semiprecious gems and mineral specimens in various areas in Virginia.

Gypsum.—Compared with 1971, output of crude gypsum decreased 16% and value decreased 10%. The raw gypsum, mined at Plasterco, Washington County, was calcined or otherwise processed and manufactured into plasterboard and other gypsum products by United States Gypsum Co. at its Plasterco plant. The company also calcined gypsum at its Berkeley plant in Chesapeake City. Output of calcined gypsum increased 42%.

Kyanite.—Production and value of kyanite increased 3% over that of 1971. Two mines and four processing plants were operated by Kyanite Mining Corp. in adjacent Buckingham and Prince Edward Counties. Shipments were principally to refractory and ceramic product manufacturers.

The bulk of the beneficiated kyanite (Al_2SiO_5) was calcined to mullite, one of the most important refractory materials used in the ceramic industry. Quartzite sand, recovered during the milling of kyanite, was marketed for industrial and construction uses. Virginia is North America's leading producer of kyanite.

Lime.—Total lime production (quick and hydrated) remained stable in quantity but increased 6% in value over that of 1971. The principal use for Virginia lime production was as a metallurgical flux in the basic oxygen steelmaking process. Water purification and sewage treatment use showed substantial increases, whereas agricultural use remained constant. Over 98% of lime sold or used was consumed in industrial applications.

Primary lime production was reported by seven companies operating seven plants in five counties. Giles, Shenandoah, and Frederick Counties accounted for over 99% of the State's output and value. The major producing companies were National Gypsum Co., Chemstone Corp., and Foote Mineral Co.

Processing equipment used in limemaking included pot, shaft, and rotary kilns and batch and continuous hydrators. Raw materials included high-calcium limestone (predominately), dolomitic limestone, and oystershell. Fuels included bituminous coal, coke, and natural gas.

Virtually the entire output was high-calcium lime. Quicklime accounted for 91% of the total production and averaged $15.07 per ton in value; hydrated lime, which equaled 9% of the total output, averaged $19.54 per ton. The average value of all lime increased from $14.56 per ton in 1971 to $15.49 per ton in 1972.

Lime consumption in Virginia was 149,700 tons, equal to 20% of the State's production. The remaining output was shipped to Pennsylvania, Ohio, Kentucky, Maryland, and 14 other States.

Lithium Compounds.—Lithium compounds were prepared by the Foote Min-

Table 7.—Viriginia: Lime sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Basic oxygen furnaces	804	4,374	883	5,884
Water purification	51	778	77	1,178
Paper and pulp	83	1,182	63	979
Electric furnaces	54	778	62	955
Sewage treatment	37	530	46	706
Construction	15	215	19	297
Agriculture	15	200	15	296
Other uses [1]	[r] 200	[r] 3,047	93	1,444
Total	759	11,049	758	11,739

[r] Revised.

[1] Includes open-hearth furnaces, other metallurgy, refractory dolomite, miscellaneous chemicals, tanning, sugar refining, acid mine water neutralization, alkalies (1971), ore concentration (1971), and petroleum refining.

eral Co. at Sunbright in Scott County using limestone mined at Sunbright and spodumene from North Carolina.

Mica.—Mica was processed in two Newport News plants. One operation is a mica-fabricating plant and the other is a plate-mica plant.

Nitrogen Compounds.—Allied Chemical Corp., Nitrogen division, Hopewell, Prince George County, using reformed natural gas, produced ammonia, urea, ammonium nitrate, and ammonium sulfate for use chiefly as fertilizer or fertilizer ingredients. The capacity of the plant at Hopewell is rated at 350,000 short tons annually of ammonia.

Salt.—Production of salt declined due to the March 1972 closure of the Olin Corp's. chlor-alkali plant in Saltville, Smyth County. This followed the shutdown in July, 1971 of Olin's soda ash plant.

Sand and Gravel.—Compared with the previous year, sand and gravel output rose 10% in quantity and 7% in value. Commercial output comprised more than 99% of total production and value; the remainder was State and local government output, mainly for use in highway maintenance. Of the commercial production, 69% was used as coarse and fine aggregates in building (41%) and paving (28%).

Sand comprised 61% of the commercial sand and gravel production and 53% of the total commercial value. Although only 4% of the sand output was marketed as special industrial silica sands used for glass melting, molding, blast, fire or furnace, engine, and other nonconstruction uses, special sand was responsible for 10% of the value.

Eighty-six percent of the total sand and gravel output was screened, washed, or otherwise processed at 69 operations. The remaining 14 operations recovered unprocessed or bank-run material. Seventy-nine percent of the commercial production was transported to market by truck.

Production of sand and gravel was reported from 38 counties and four independent cities. In order of output, the principal sand- and gravel-producing areas were Chesterfield County, Charles City County, City of Virginia Beach, Fairfax County, and Henrico County.

Forty-five of the 83 sand and gravel operations had an annual output range of up to 50,000 tons and accounted for 5% of the total tonnage; 27 operations had an output range of from 50,000 to 500,000 tons, and accounted for 29%; eight had an output range of from 500,000 to 1,000,000 tons and accounted for 38%; and three had an output range over 1,000,000 tons and accounted for 28%. The bulk of the sand and gravel recovery was by dredging and open pit mining; a sizable tonnage of industrial silica sand was produced from crushed sandstone and quartzite, and a limited amount was obtained in the processing of kyanite.

Soapstone.—Crushed and ground soapstone was produced by Blue Ridge Talc Co., Inc., principally for use in insecticides and foundry facings. Output and value increased over that of the previous year.

Dimension soapstone was produced by Alberene Stone Division, Georgia Marble Co., and is included in the Stone section of this chapter.

Stone.—Virginia's stone production in

Table 8.—Virginia: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	4,617	6,816	3,326	4,989
Engine	W	W	29	95
Fill	425	186	1,912	W
Glass	W	W	W	847
Paving	2,703	2,641	2,654	2,773
Other uses [1]	730	1,838	555	2,708
Total [2]	8,475	11,481	8,477	11,412
Gravel:				
Building	3,242	6,874	2,359	4,478
Paving	882	1,535	1,292	2,025
Miscellaneous	W	W	20	25
Other uses [3]	177	307	1,828	3,708
Total [2]	4,301	8,717	5,498	10,235
Government-and-contractor operations:				
Sand:				
Fill	14	1	51	18
Paving	--	--	27	3
Other uses	2	2	(4)	(4)
Total	16	3	78	21
Gravel:				
Fill	5	(4)	1	(4)
Paving	--	--	31	27
Total	5	(4)	32	27
Total sand and gravel [2]	12,796	20,201	14,085	21,696

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes railroad ballast, blast, engine, filtration (1971), fire or furnace, glass, molding, fill, and other industrial sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes fill, railroad ballast (1971), and other uses.

[4] Less than ½ unit.

1972 broke all previous State records in both output and value. Stone, the second most important mineral commodity produced in the Commonwealth, accounted for 15% of the State's total mineral production value in 1972. Production totaled 40 million tons valued at $74.1 million, a gain of 15% in output and 17% in value over that of 1971. Contributing most to the gains in output and value were increases in granite and traprock.

Various types of stone were mined or quarried in the State; in order of output value, they were limestone, granite, traprock, slate, miscellaneous stone, sandstone, marble, quartzite, quartz, and marl. Both dimension stone and crushed or broken stone were produced.

Dimension stone was produced at eight operations in five counties, and although a low-output commodity in terms of tonnage (less than 0.1% of total stone production), it accounted for 3.6% of the total stone output value. The use of dimension stone, in decreasing order of quantities produced, were flagging, structural, roof slate, irregular shapes, and cut or sawed.

Crushed stone was produced from all the stone types and contributed over 99.9% of the total stone quantity and 96.4% of the total stone value. Of the total crushed stone ouput 81% was used for building purposes (aggregate and roadstone) 4% for cement, 4% for lime, 3% for agricultural use, and the remainder as railroad ballast, riprap and jetty stone, flux, and miscellaneous and unspecified applications. Crushed stone increased 15% in output and 20% in value over that reported in 1971. The average value per ton for crushed stone rose to $1.79 from $1.72 in 1971.

Commercial stone was produced at 140 operations in 53 counties and one independent city. In terms of tonnage the principal stone-producing counties were

Loudoun (traprock and granite), Botetourt (limestone), Fairfax (traprock and granite), Prince William (granite and traprock), and Frederick (limestone). In terms of value, the most important counties were Loudoun, Fairfax, Prince William, Frederick, and Botetourt. The aforementioned five counties accounted for 31% of the total stone output and 34% of the total stone value. Fourteen counties produced more than 1 million tons each, and 27 counties had output valued in excess of $1 million each.

Shipments of crushed stone products, in million short tons, by method of transportation, were distributed as follows: 29.6 by truck, 7.4 by railroad, 0.1 by waterway, and 2.8 by other and unspecified methods.

Sulfur.—Hydrogen sulfide, recovered from fuel gas, was converted to elemental sulfur by AMOCO at its Yorktown refinery. Shipments increased 13% over that of 1971, but the value of shipments declined 12% due to a lower unit value in 1972. Production and sales were approximately equal.

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Iron Ore (Pigment Material).—Natural iron-oxide pigments were produced by one firm at Hiwassee, Pulaski County, from

Table 9.—Virginia: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone total	r 25	r 3,907	17	2,645
Crushed and broken stone:				
Bituminous aggregate	2,511	4,271	2,756	5,137
Concrete aggregate	5,250	8,551	4,180	6,888
Dense graded road base stone	11,755	20,219	16,310	29,047
Macadam aggregate	1,185	2,307	1,222	2,040
Surface treatment aggregate	1,789	3,138	1,484	2,530
Unspecified aggregate and roadstone	3,877	4,973	6,505	11,119
Agricultural limestone [1]	1,220	2,694	1,098	2,080
Cement	2,099	2,637	W	1,556
Flux	393	826	223	394
Lime	1,559	2,668	1,432	2,382
Railroad ballast	482	599	496	665
Riprap and jetty stone	121	231	289	595
Stone sand	127	318	208	396
Other uses [2]	r 2,899	r 6,142	3,767	6,615
Crushed total [3]	r 34,618	r 59,575	39,970	71,445
Grand total [3]	34,643	63,482	39,987	74,090

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Data include stone used in poultry grit and mineral food.

[2] Includes stone used for agricultural marl (1971), filter stone, terrazzo, chemicals, mine dusting, asphalt filler, other filler, drain fields, glass, lightweight aggregates, chemical stone (1971), paper manufacture (1972), roofing aggregates, and other uses not specified.

[3] Data may not add to totals shown because of independent rounding.

Table 10.—Virginia: Stone sold or used by producers, by kind

(Thousand short tons and thousand dollars)

Kind of stone	1971		1972	
	Quantity	Value	Quantity	Value
Limestone [1]	18,301	29,778	W	W
Granite	10,532	18,826	14,257	25,990
Sandstone	817	1,558	W	W
Slate	614	3,160	W	W
Traprock	3,553	7,222	4,561	9,877
Undistributed [2]	826	2,937	21,169	38,224
Total [3]	34,643	63,482	39,987	74,090

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Limestone used generally to include dolomite.

[2] Includes marble, marl, other stone, quartz, quartzite, shell.

[3] Data may not add to totals shown because of independent rounding.

local deposits of earthy forms of hydrous and anhydrous iron oxides including ocher, sienna, and umber. Manufactured iron oxides, also for use in pigment manufacture and for other purposes, were produced at the company's Pulaski facilities. Natural iron-oxide pigments were also produced by a firm at Henry, Henry County, from hematite obtained out-of-State. The finished iron-oxide pigments are used in cement, paint manufacture, printing inks, and other products. Total marketed output increased 47%, and total value increased 69% above that of the previous year.

Lead and Zinc.—Lead and zinc were recovered from two mines in Wythe County operated by the same company. The ratio of zinc recovery to that of lead was about 4.9 to 1. Lead production increased 2%, and value increased 11%. Zinc production remained substantially the same, but value increased 10%.

Table 11.—Virginia: Mine production of recoverable lead and zinc

Year	Lead		Zinc	
	Short tons	Value (thousands)	Short tons	Value (thousands)[1]
1968	3,573	$944	19,257	$5,199
1969	3,358	1,000	18,704	5,462
1970	3,356	1,048	18,063	5,534
1971	3,386	934	16,829	5,419
1972	3,441	1,034	16,789	5,960

[1] Recoverable zinc valued at the yearly average price of prime western-slab zinc, East St. Louis market. Value established after transportation, smelting, and manufacturing charges have been added to the value of the ore at the mine.

Manganese.—Imported ore was processed in a plant at Newport News by the Consumer Products Division of Union Carbide Corp. for company use. A grinding plant for imported ore was operated by C-E Minerals Division of Combustion Engineering, Inc., at Lynchburg.

Table 12.—Principal producers

Commodity and company	Address	Type of activity	County
Aplite (crude):			
International Minerals & Chemical Corp., Industrial Minerals Div.	Piney River, Va. 22964	Quarry	Nelson.
The Feldspar Corp	Route 1, Box 28 Montpelier, Va. 23192	do	Hanover.
Cement:			
Lone Star Industries, Inc.[1]	3315 W. Broad St. Richmond, Va. 23230	Plant and quarry	Botetourt.
Lone Star Industries, Inc.[2]	do	Plant	Chesapeake (City).
Riverton Corp.[3]	Riverton, Va. 22651	Quarry and plant	Warren.
Clays (miscellaneous and shale):			
Brick and Tile Corp. of Lawrenceville.	P.O. Box 45 Lawrenceville, Va. 23868	Pit and plant	Brunswick.
Do	do	Pit	Greensville.
General Shale Prod. Corp	Box 3547 Johnson City, Tenn. 37601	Pits and plants	Chesterfield, Smyth, Tazewell.
Clinchfield Coal Company, Div. of The Pittston Co.[4]	Dante, Va. 24237	Plant	Russell.
Lone Star Industries, Inc	Box 6237 West End Branch Richmond, Va. 23230	Pits	Botetourt and Nansemond.
Old Virginia Brick Co., Inc.	P.O. Box 508 Salem, Va. 24153	do	Roanoke.
Do	do	Pit	Montgomery.
Redford Brick Co	Box 4096 Richmond, Va. 23224	Pit and plant	Chesterfield (City of Richmond).
Weblite Corp	Box 780 Roanoke, Va. 24004	do	Botetourt.
Webster Brick Co., Inc	do	Pit	Botetourt, Nansemond, Orange.
Woodbridge Clay Products Co.	Rt. 3, Box 240 Manassas, Va. 22110	do	Prince William.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal (Bituminous):			
Clinchfield Coal Co. [5]	Dante, Va. 24237	Underground mine	Buchanan.
Clinchfield Coal Co. [6]	do	do	Dickenson.
Clinchfield Coal Co. [7]	do	do	Russell.
Coal Processing Corp	Box 497 Norton, Va. 24273	do	Wise.
Harman Mining Corp. [8]	Harman, Va. 24618	do	Buchanan.
Island Creek Coal Co. [6]	Box 113 Keen Mountain, Va. 24624	do	Do.
Westmoreland Coal Co. [9]	P.O. Box 229 Big Stone Gap, Va. 24219	do	Wise.
Contracting Enterprises, Inc.	Box 430 Clintwood, Va. 24228	Strip and auger mine.	Dickenson.
Sterling Mining Co. [3]	Box 1187 Wise, Va. 24293	do	Wise.
General Trucking Corp	Box 389 Appalachia, Va. 24216	do	Do.
Coke:			
Christie Coal and Coke Co., Inc.	P.O. Box 409 Norton, Va. 24273	Plant	Do.
Jewell Smokeless Coal Corp.	Jewell Valley, Va. 24623	do	Buchanan.
Gypsum:			
United States Gypsum Co. [10]	101 S. Wacker Drive Chicago, Ill. 60606	do	Chesapeake (City).
United States Gypsum Co.	do	Mine and plant	Washington.
Iron-oxide pigments (crude): Hercules, Inc., Imperial Color & Chemical Dept. [11]	Hiwassee, Va. 24347	do	Pulaski.
Iron-oxide pigments (finished): Blue Ridge Talc Co., Inc.	P.O. Box 7 Henry, Va. 24102	Plant	Franklin.
Kyanite:			
Kyanite Mining Corp. [12]	Dillwyn, Va. 23936	Mine and plants	Buckingham.
Do	do	do	Prince Edward.
Lime:			
Battery Park Fish & Oyster Co. [13]	Battery Park, Va. 23304	Plant	Isle of Wight.
Blue Grass Lime Co. [14]	Route 3 Tazewell, Va. 24651	do	Tazewell.
Chemstone Corp. [14]	Menlo Park Edison, N.J. 08817	do	Shenandoah.
Foote Mineral Co. [14]	Route 100 Exton, Pa. 19341	do	Giles.
W. S. Frey Co., Inc. [14]	257 E. Market St. York, Pa. 17403	do	Frederick.
M. J. Grove Lime Co., Div. of The Flintkote Co. [14]	Lime Kiln, Md. 21763	do	Do.
National Gypsum Co. [14]	325 Delaware Ave. Buffalo, N.Y. 14202	do	Giles.
Petroleum refineries: American Oil Co. [15]	Yorktown, Va. 23490	do	York.
Salt: Olin Corp. [16]	120 Long Ridge Rd. Stamford, Conn. 06905	Brine wells	Smyth.
Sand and gravel:			
Friend Sand and Gravel Co.	Box 388, 209 River St. Petersburg, Va. 23801	Pit	Chesterfield.
Massaponax Sand & Gravel Corp.	P.O. Box 270 Fredericksburg, Va. 22401	do	Spotsylvania.
Solite Corp	P.O. Box 883 Fredericksburg, Va. 22401	do	King George.
Southern Materials Co., Inc.	2125 Kimball Terrace Norfolk, Va. 23504	Pit and dredge	Chesterfield.
Do	do	Dredge	Henrico.
Do	do	Pits	Isle of Wight and Prince George.
Virginia Concrete Co., Inc.	P.O. Box 666 Springfield, Va. 22150	Pit	Fairfax.
Warren Bros. Co	1400 Roseneath Road Richmond, Va. 23230	Pits	Charles City and Henrico.
West Sand and Gravel Co.	Box 6008 Richmond, Va. 23222	do	Henrico and Rockingham.
E. V. Williams Co., Inc.	P.O. Box 938 Norfolk, Va. 23501	do	Virginia Beach (City).
Williams Paving Co., Inc.	do	do	Halifax.
Soapstone (talc): Blue Ridge Talc Co., Inc. [17]	P.O. Box 8 Henry, Va. 24102	Mine and plant	Franklin.

See footnotes at end of table.

Table 12.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone:			
Blue Ridge Stone Corp	Box 2459 Roanoke, Va. 24010	Quarry	Botetourt.
Chantilly Crushed Stone Co.	Box 12 Chantilly, Va. 22021	do	Loudoun.
Flintkote Co., Grove Mt.	Frederick, Md. 21701	do	Frederick.
General Crushed Stone Co.	712 Drake Bldg. Easton, Pa. 18042	do	Hanover.
Hercules, Inc	Wilmington, Del. 19899	do	Amherst.
Lone Star Industries, Inc., Stone Materials.	P.O. Box 6237 Richmond, Va. 23230	do	Botetourt.
Luck Quarries Inc., Augusta Stone Corp.	Box 4682 Richmond, Va. 23229	do	Augusta.
Martin-Marietta Corp	Box 2479 Raleigh, N.C.	do	Albemarle.
Pounding Mill Quarry Corp	Box 2459 Roanoke, Va. 24010	do	Tazewell.
Rockydale Quarries Corp.	Route 8, Box 635 Roanoke, Va. 24004	do	Roanoke.
Salem Stone Corp	P.O. Box 1121 Roanoke, Va. 24153	Quarries	Montgomery and Roanoke.
Stuart M. Perry, Inc	Box 738 Winchester, Va. 22601	do do	Clarke. Frederick.
Tidewater Crushed Stone & Asphalt Co., Inc.	Deepwater Terminal Rd. Richmond, Va. 23234	Quarry	Chesterfield (City of Richmond).
Trego Stone Corp	Box 2459 Roanoke, Va. 24010	do	Greensville.
Vulcan Materials Co	P.O. Box 7506, Reynolds Sta. Winston-Salem, N.C. 27109	Quarries	Brunswick, Fairfax, Goochland, Halifax, Mecklenburg, Pittsylvania, Prince William, Rockingham.

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[1] Portland and masonry cement; also captive production of limestone and shale.
[2] Portland cement only; also captive production of marl and clay in Nansemond County.
[3] Masonry cement only; also produce limestone.
[4] Shale obtained from coal preparation plant as a coproduct.
[5] 10 mines.
[6] 5 mines.
[7] 3 mines.
[8] 2 mines.
[9] 9 mines.
[10] Process imported gypsum.
[11] Also finished iron oxide pigments.
[12] Coproduct: quartz sand.
[13] Calcine oystershell.
[14] Also captive production of limestone.
[15] Coproducts: sulfur and coke.
[16] Various chemicals manufactured from salt and lime at plant; captive limestone converted to lime for use in chemical manufacturing.
[17] Also process out-of-State hematite at plant for pigment manufacture.

The Mineral Industry of Washington

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Washington Division of Mines and Geology for collecting information on all minerals.

By Robert A. Whitman[1]

The value of mineral production increased 16% to $109.8 million in 1972. This reflects large increases in the production of coal and gypsum, and lesser increases in cement, stone, and olivine. Production of all metallic minerals except zinc and tungsten declined. The value of nonmetallic production in 1972, in current dollars, increased 8% over that of 1971.

The State produced 132,000 tons more aluminum than in 1971. This brought the total State output up to 26% of the total U.S. production.

The Puget Sound Air Pollution Control Agency allowed the Tacoma smelter of the American Smelting and Refining Company (Asarco) a variance until December 31, 1976, at which time a 90% removal of sulfur dioxide from the stack gas will be required.

A pilot plant for solvent-refining of coal was started with a formal groundbreaking ceremony in October. The 50-ton-per-day plant will cost about $18 million. The process will reduce the amount of sulfur and ash in the coal, thus decreasing the amount of air pollution when the coal is

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[1] Physical scientist, Division of Nonferrous Metals.

Table 1.—Mineral production in Washington [1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Cement:				
Portland .... thousand short tons..	1,149	$23,735	1,239	$26,848
Masonry .... do....	5	145	6	170
Clays [2] .... do....	255	549	264	584
Coal (bituminous) .... do....	1,134	7,614	2,635	17,424
Gem stones	NA	155	NA	163
Gypsum .... thousand short tons..	W	W	5	13
Lead (recoverable content of ores, etc.) .... short tons..	5,177	1,429	2,567	772
Peat .... thousand short tons..	17	72	18	89
Sand and gravel .... do....	22,702	26,658	23,065	26,069
Silver (recoverable content of ores, etc.) . thousand troy ounces..	W	W	221	372
Stone .... thousand short tons..	12,436	20,489	14,712	[3] 23,764
Zinc (recoverable content of ores, etc.) .... short tons..	5,782	1,862	6,483	2,301
Value of items that cannot be disclosed: Copper, diatomite, gold, grinding pebbles (1971), lime, olivine, pumice, stone (dimension) (1972), talc and soapstone, tungsten (1972), uranium, and values indicated by symbol W	XX	11,893	XX	11,237
Total	XX	94,601	XX	109,806
Total 1967 constant dollars	XX	80,439	XX	p 90,958

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

[3] Excludes dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in Washington, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Adams	W	$2,543	Stone, sand and gravel.
Asotin	$2	20	Stone.
Benton	W	W	Sand and gravel.
Chelan	340	366	Sand and gravel, stone.
Clallam	1,360	1,028	Stone, clays, sand and gravel.
Clark	W	2,073	Stone, sand and gravel, clays.
Columbia	W	109	Stone.
Cowlitz	449	1,527	Stone, sand and gravel, clays.
Douglas	W	W	Sand and gravel, clays.
Ferry	W	W	Gold, silver, stone, copper, lead.
Franklin	W	W	Sand and gravel, stone.
Garfield	W	W	Stone.
Grant	2,789	5,416	Sand and gravel, stone, diatomite, lime.
Grays Harbor	1,049	1,020	Sand and gravel, stone.
Island	W	W	Do.
Jefferson	W	W	Stone, sand and gravel.
King	21,729	22,881	Cement, sand and gravel, stone, coal, clays, peat.
Kitsap	W	674	Sand and gravel, stone, peat, pumice.
Kittitas	226	180	Stone, clays, sand and gravel, pumice.
Klickitat	W	291	Stone, sand and gravel.
Lewis	W	W	Coal, stone, sand and gravel, clays.
Lincoln	W	175	Stone.
Mason	217	W	Sand and gravel, stone.
Okanogan	W	W	Stone, sand and gravel, gypsum.
Pacific	766	419	Stone.
Pend Oreille	9,090	8,478	Cement, zinc, copper, stone, sand and gravel, gold, silver.
Pierce	6,255	6,307	Sand and gravel, lime, stone, clays.
San Juan	W	W	Sand and gravel, stone.
Skagit	1,918	2,051	Olivine, sand and gravel, stone, talc.
Skamania	W	249	Stone, pumice, sand and gravel, gold, silver, copper, lead.
Snohomish	3,299	5,425	Sand and gravel, stone, peat, clays.
Spokane	2,955	3,260	Sand and gravel, stone, clays, peat.
Stevens	5,619	5,207	Uranium, stone, sand and gravel, tungsten, clays.
Thurston	W	686	Sand and gravel, stone, peat.
Wahkiakum	1	W	Sand and gravel, stone.
Walla Walla	407	W	Do.
Whatcom	W	W	Cement, stone, sand and gravel, clays.
Whitman	1,458	W	Stone, sand and gravel.
Yakima	2,257	1,785	Sand and gravel, stone, lime.
Undistributed [1]	32,421	37,782	
Total[2]	94,601	109,806	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

burned. Samples of coals from several different U.S. localities will be tested.

A gold property was reopened by the Baxter Mining Co. in Skamania County.

Legislation and Government Programs.—The Division of Surveys and Marine Land Management of the State Department of Natural Resources included a statement on mining in their proposed State aquatic land plan through efforts of the State Liaison Officer of the Federal Bureau of Mines. The statement was to the effect that "Extraction of offshore mineral resources should be encouraged, providing such operations have no significant adverse impact on fish, wildlife, and plantlife, and other resources of the State's offshore waters."

The State Division of Mines and Geology moved from the General Administration Building to larger quarters at 14th and Jefferson Streets in Olympia, several blocks from the Capitol.

An aeromagnetic surveying project, a cooperative undertaking between the State and the U.S. Geological Survey, completed the survey of sixteen 15-minute quadrangles during 1972.

The Western Field Operation Center of the Bureau of Mines assisted in the financing of a program to photograph old coal mine maps to a constant negative size. Photographing of mine maps of the area around Issaquah was completed, and maps of the Rosslyn area were to be photographed next.

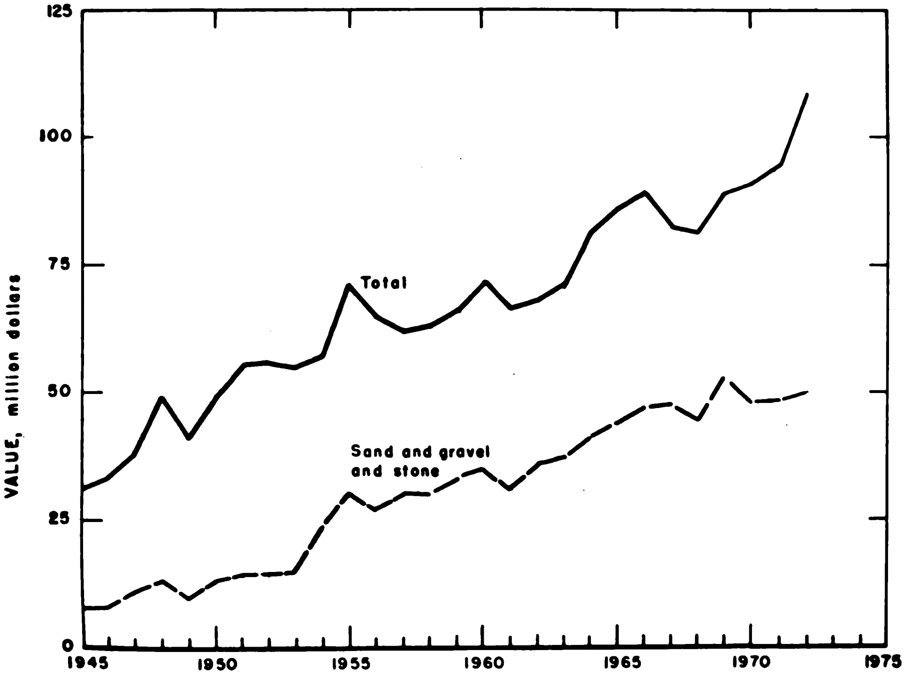

Figure 1.—Value of sand and gravel and stone, and total value of mineral production in Washington.

Table 3.—Indicators of Washington business activity

(Thousands)

	1971	1972[p]	Change, percent
Annual average labor force and employment:			
Total labor force ---- thousands	1,426.3	1,428.8	+0.2
Unemployment ---- do	155.5	129.7	−16.6
Employment:			
Construction ---- do	54.0	52.0	−3.7
Aerospace ---- do	40.5	40.7	+.5
Lumber and wood products ---- do	43.4	46.2	+6.4
Food processing ---- do	28.2	28.2	--
All manufacturing ---- do	214.7	221.8	+3.3
All industries ---- do	850.5	874.3	+2.8
Personal income:			
Total ---- millions	$14,221	$15,410	+8.4
Per capita	$4,132	$4,476	+8.3
Construction activity:			
Value of nonresidential construction ---- millions	$210.6	$255.4	+21.3
State highway commission: Value of contracts awarded ---- do	$139.0	• $184.0	+32.4
Cement shipments to and within Washington ---- thousand short tons	1,222	1,098	−10.2
Farm marketing receipts ---- millions	$882.6	$1,080.9	+22.5
Mineral production value ---- do	$94.6	$109.8	+16.1

• Estimate. [p] Preliminary.

Sources: The Washington State Economy-1972, Regional Highlights; Roads and Streets; Survey of Current Business; Construction Review; Farm Income Situation; Area Trends in Employment and Unemployment; and the U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	164	230	38	302	--	9	29.76	NA
Metal	264	265	70	561	--	35	62.42	2,490
Nonmetal	97	161	16	125	--	3	23.94	734
Sand and gravel	1,102	197	217	1,753	2	50	29.66	7,767
Stone	1,156	182	211	1,689	3	27	17.77	11,040
Total	2,783	198	[1] 551	4,430	5	124	29.12	NA
1972:[2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	190	275	52	416	--	42	100.86	6,988
Nonmetal	70	191	13	104	--	2	19.19	77
Sand and gravel	745	161	120	972	1	26	27.77	6,886
Stone	595	181	107	866	--	18	20.77	329
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data does not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

Ecology.—The Tacoma smelter of Asarco in January was granted a variance for sulfur dioxide (SO_2) removal from gases discharged by the smelter to the outside air until December 31, 1976. It will then be necessary to remove 90% of the SO_2. In August Asarco awarded a contract to Stearns-Roger, Corp., for the design and construction of a liquid sulfur dioxide facility at the Tacoma smelter. The new addition should capture all particulate matter from the converters in the smelter and recover about 51% of the SO_2 generated.

The Knob Hill gold property in Ferry County was surveyed for emissions of aldehydes, nitrogen dioxide, carbon monoxide, and dust following blasting operations. The operation met all the standards enforced by the Industrial Hygiene Section of the Department of Labor and Industries.

A draft of a mined-land reclamation bill resulting from a meeting called by the Northwest Mining Association was submitted to the Interior Committee of the U.S. House of Representatives for consideration.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Cement.—Shipments of portland cement in 1972 increased 8% over those of 1971 to 1.2 million short tons valued at $26.8 million. Shipments of 5,632 tons of prepared masonry cement valued at $169,918 represented an increase of 10% over quantities shipped in 1971. Output was from four plants, (three wet and one dry process), each producing both portland and prepared masonry cement. Most of the cement produced was of types I and II, the general use classifications.

Principal consumers were ready-mix concrete plants, followed by concrete product manufacturers, highway and other contractors, and building material dealers.

Clays.—Clay was produced in 12 counties, but six counties produced 90% of the total. Only two counties produced fire clay.

Lime.—Domtar Chemicals, Ltd., and Utah-Idaho Sugar Co. produced lime in Grant, Pierce, and Yakima Counties for sugar refining, paper and pulp processing, calcium carbide production, sewage treatment, and other uses. Output increased 17% and was 8% above the 1969 record. The lime was consumed in Washington, Oregon, and other nearby western States.

Table 5.—Washington: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,098	4,277	3,228	4,721
Fill	752	685	892	640
Glass	W	W	53	480
Paving	1,746	2,037	1,249	1,723
Other uses [1]	61	503	28	54
Total [2]	5,652	7,502	5,451	7,619
Gravel:				
Building	3,990	5,412	4,353	6,156
Fill	1,911	1,323	1,579	958
Paving	7,676	9,663	5,939	7,491
Railroad ballast	322	240	189	178
Miscellaneous	15	23	464	594
Other uses	82	96	290	444
Total	13,996	16,757	12,814	15,821
Government-and-contractor operations:				
Sand:				
Building	382	263	--	--
Fill	12	2	W	W
Paving	210	305	W	W
Other uses [3]	81	53	387	385
Total [2]	684	622	387	385
Gravel:				
Building	36	61	35	59
Fill	291	106	1,380	301
Paving	2,028	1,607	2,948	1,883
Other uses	15	1	52	([4])
Total [2]	2,370	1,776	4,414	2,243
Total sand and gravel [2]	22,702	26,658	23,065	26,069

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."
[1] Includes blast (1971), and other sands, unground and ground.
[2] Data may not add to totals shown because of independent rounding.
[3] Includes fill, paving, and other uses.
[4] Included with paving gravel.

Total lime consumption in Washington was 164,000 tons.

Sand and Gravel.—The total quantity of sand and gravel produced in 1972 was nearly 2% more than was produced in 1971. The value of production decreased about 2%. Commercial operations produced 79% of the total, while the proportion produced by Government crews of contractors increased to 21%. Over 33 counties reported production, but Grant, King, Pierce, Snohomish, and Spokane Counties produced 53% of the total.

The combined output of sand and gravel was used as follows: Paving, 44%; building, 33%; fill, 17%; and other uses, 6%.

Stone.—The quantity of crushed and broken stone sold or used by producers increased by 18% over that of 1971. The value increased by 17%. There were 273 quarries in 37 counties, but 98 quarries in five counties produced 42% of the stone reported. There were 10 counties, for each of which the value of production was over $1 million. Four uses, riprap, road base, surface treatment, and aggregate, consumed about 77% of the crushed stone.

Traprock constituted about 77% of the stone quarried and came from 213 quarries in 30 counties. Over 80% was used for aggregate, road material, and riprap. Granite was produced in 38 quarries in seven counties and accounted for 8% of the stone. It also was used principally for aggregate, road treating material, and riprap Thirteen quarries produced limestone to furnish 7% of the total stone output. Cement and lime manufacture used 75% of the limestone.

Table 6.—Washington: Stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension stone total	2	138	3	W
Crushed and broken:				
Bituminous aggregate	911	1,437	517	926
Concrete aggregate	91	143	408	W
Macadam aggregate	196	333	W	375
Dense graded road base stone	3,051	5,335	1,712	2,810
Surface treatment aggregate	1,779	2,813	2,654	4,079
Unspecified aggregate and roadstone	2,888	3,314	5,419	7,443
Agricultural limestone	8	W	15	W
Metallurgical purposes [1]	54	142	72	215
Fill	W	W	184	132
Railroad ballast	W	W	321	543
Riprap and jetty stone	1,708	3,327	1,489	2,087
Other uses [2]	1,747	3,507	1,918	5,204
Total crushed [3]	12,434	20,351	14,708	23,764
Grand total [3]	12,436	20,489	14,712	W

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Data include ferrosilicon and flux stone.

[2] Data include stone used in cement, lime, and paper manufacture, stone sand, filter stone, terrazzo, roofing aggregate, abrasives, building products, glass, asphalt filler, and other uses in smaller quantities.

[3] Data may not add to totals shown because of independent rounding.

METALS

Aluminum.—Production of primary aluminum increased by 14% in 1972 compared with that of 1971. Value of production was only 4% over that for 1971. Washington State's share of national production was 26%.

Intalco Aluminum Corp. programmed total expenditures of about $15.4 million for control of air and water pollution at their Ferndale plant. The company had direct digital computer control of one potline in 1971. Similar systems were installed on the other two potlines in 1972.

Reynolds Metals Co. reopened two 50,000-ton-per-year potlines at its Longview plant in April.

Copper.—An old property in the Sultan Basin has been diamond drilled extensively by Bren Mac Mines, Ltd. With over 17,000 feet of diamond drilling, 800 feet of percussion drilling, and underground development comprising 3,728 feet of adit, 1,256 feet of crosscut, and 557 feet of drift, they

Table 7.—Washington: Primary aluminum plant capacity and production data

Year	Rated primary capacity (thousand short tons)	Primary production			Average U.S. ingot price per pound (cents)
		Quantity (thousand short tons)	Percent of national total	Value (thousands)	
1968	988	775	24	$394,261	25.1
1969	1,012	1,008	26	541,834	26.5
1970	1,012	1,028	26	569,877	27.8
1971	1,147	984	24	516,407	27.6
1972	1,147	1,066	26	585,247	25.1

report nearly 29 million tons of measured and indicated ore averaging 0.354% copper with additional values in molybdenum, tungsten, gold, and silver. There are an additional 18 million tons of ore indicated with the copper averaging 0.433%.

The most important mineralized structure in the Basin is the Sunrise breccia pipe which at the surface is about 650 feet long and up to 250 feet wide. At the 3,000-foot level the breccia is an elliptical zone with the long axis about 1,000 feet and the short axis about 400 feet. Bren Mac has a total of about 11,900 acres in claims including 16 State mineral leases, all in eastern Snohomish County.

Another large deposit of low-grade copper was reported about 5 miles north of Snoqualmie Pass. The U.S. Development Corp. reported extensive drilling in addition to about 2,000 feet of adit.

Gold-Silver.—Gold production at the Republic camp in Ferry County may end in about 2 years unless higher prices for gold and silver allow the mining of lower grade material than the present cutoff point.

The Wind River property in Skamania County was reopened by the Baxter Mining Co. One shipment was sent to the Tacoma smelter.

Lead-Zinc.—There was quite a bit of exploration activity in the lead-zinc districts of the State, some encouraging, some not. A new tabular zinc ore body in the Yellowhead horizon was discovered on the west side of the Pend Oreille River across from the present mine of Pend Oreille Mines & Metals Co. The company was sinking an inclined shaft from the present underground workings, and hoped to intersect the new ore body sometime in 1973.

The Calhoon property in Stevens County was drilled by the J. R. Simplot Co. of Boise, Idaho. The firm also worked on the Nevada Consolidated, Inc., property. Washington Resources, Inc. negotiated with an American-Canadian combine to reopen the Calhoun zinc mine about 7 miles south of Northport. Concentrates would be shipped to Trail, British Columbia, rather than to Great Falls, Mont., a distinct saving in freight from the operation by the American Zinc Co. It was reported that the Callahan Mining Corp. decided not to undertake development of the Van Stone property.

The Bunker Hill Co., a subsidiary of Gulf Resources & Chemical Corp., did geophysical and geochemical work and diamond drilling at the leased State Creek property, 14 miles northeast of Metaline Falls in Pend Oreille County. Vanguard Exploration Co., which was phased out early in 1972 as a subsidiary of Gulf Resources, was the original lessee.

Magnesium.—The Aluminum Company of America (Alcoa) through application for sales tax deferral on investment, revealed plans to start construction on their $50 million magnesium plant near Addy in Stevens County. The plant buildings were estimated to cost $20 million, with equipment and machinery adding another $31 million. Alcoa planned to use a magnatherm process from France for electrochemical production of magnesium, with silicon as a byproduct. Initial capacity was planned for 24,000 tons of magnesium per year produced by a work force of about 250 people.

MINERAL FUELS

Coal.—Output of coal in 1972 more than doubled the production for 1971 in the State. The strip mine of the Washington Irrigation & Development Co. accounted for 98.6% of the total output. This coal is used entirely for the company's powerplant. Equipment at the power generating plant failed to keep air pollution below acceptable levels when operating more than one generator. The mine, therefore, continued to be operated at about 50% capacity.

Ground was broken for a pilot plant for solvent-refined coal. The 50-ton-per-day plant is financed by the Office of Coal Research of the Department of the Interior. Operation of the $18 million plant will be by contract with the Pittsburgh & Midway Coal Mining Co., a subsidiary of Gulf Oil Corp. The plant reduces the amount of sulfur and ash in the coal, whereby reducing air pollution when the coal is burned. The filtered solution produced by the plant will be vacuum-flash evaported to form combustible prills which are expected to furnish about 16,000 Btu per pound. Samples of coal from various U.S. sources will be tested to determine their amenability to the process.

Peat.—Peat was produced in five counties during 1972, with Thurston County continuing to lead in production. Snohomish County was second in the State. Production increased about 6% over that of 1971, but the value per ton increased about 17%.

Petroleum and Natural Gas.—The Washington Water Power Co. reported natural gas supplies sufficient to supply a growing market for several years. However, the company implied that future gas supplies inevitably will cost more.

Union Oil Co. of California stopped drilling an apparently unsuccessful test well near Port Gamble in Kitsap County. Mobile Oil Corp. abandoned a test well near Kingston, about 7 miles east of Port Gamble. Neither company announced any findings resulting from the drilling. Standard Oil Co. of California continued its drilling program in Snohomish County.

Table 8.—Principal producers

Commodity and company	Address	Type of activity	County
NONMETALS			
Cement:			
Columbia Cement Co., Div. of PPG Industries, Inc.	Marietta Road, P.O. Box 37 Bellingham, Wash. 98225	Plant	Whatcom.
Ideal Cement Co , Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	do	King.
Lehigh Portland Cement Co.[1]	718 Hamilton St. Allentown, Pa. 18105	do	Pend Oreille.
Lone Star Cement Corp	P.O. Box 2047 Seattle, Wash. 98111	do	King.
Clays:			
Chehalis Brick & Tile Co	P.O. Box 868 Chehalis, Wash. 98532	Pit and plant	Lewis.
Cle Elum Cement Products, Inc	P.O. Box 336 Cle Elum, Wash. 98922	do	Kittitas.
R. L. Fleshman	2804 Spirit Lake Highway Castle Rock, Wash. 98611	Pit	Cowlitz.
Hidden Brick Co	2610 Kauffman Ave. Vancouver, Wash. 98660	Pit and plant	Clark.
Jim Hoy Co	1757 W. Bakerview Road Bellingham, Wash. 98225	Pit	Whatcom.
Ideal Cement Co., Div. of Ideal Basic Industries, Inc.	420 Ideal Cement Bldg. Denver, Colo. 80202	Pit and plant	Clallam.
Interpace Corp	2901 Los Feliz Blvd. Los Angeles, Calif. 90039	3 pits and plants	King.
		2 pits and plants	Spokane.
		Pit and plant	Stevens.
Lind Gravel Co	1530 State St. Bellingham, Wash. 98225	Pit	Whatcom.
Lowell Brick Co	Box 3005 Everett, Wash. 98203	Pit and plant	Snohomish.
Mutual Materials Co	P.O. Box 3547 Seattle, Wash. 98124	do	King, Pierce.
Wenatchee Silica Sand Co	Box 1668 Wenatchee, Wash. 98801	Pit	Douglas.
Diatomite: Kenite Corp., Div. of Witeo Chem. Corp.	277 Park Ave. New York, N.Y. 10017	Mine and plant	Grant.
Gypsum: Agro Minerals, Inc	P.O. Box Call Tonasket, Wash. 98855	Plant	Okanogan.
Lime: Domtar Chemical, Inc	1220 Alexander Ave. Tacoma, Wash. 98421	do	Pierce.
Olivine:			
Northwest International	329 Kincaid Mount Vernon, Wash. 98273	Mine and plant	Skagit.
Olivine Corp	1015 Hilton Bellingham, Wash. 98225	do	Do.

See footnotes at end of table.

Table 8.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Pumice and pumicite:			
W. L. Marenakos Co	Rt. 1, Box 921 Issaquah, Wash. 98027	Plant	Kittitas.
Weyerhaeuser Co	Box 188 Longview, Wash. 98632	do	Skamania.
Sand and gravel:			
Ace Concrete Co	N. 302 Park Road Dishman, Wash. 99206	Pit and plant	Spokane.
Associated Sand & Gravel Co	6300 Glenwood Ave. Everett, Wash. 98202	do	Snohomish.
Cadman Gravel Co	P.O. Box 538 Redmond, Wash. 98052	do	King.
Central Pre-Mix Concrete	805 N. Division St. Spokane, Wash. 99202	do	Spokane, Adams, Franklin.
DeAtley Corp.[2]	Box 648 Lewiston, Idaho 83501	do	Various.
Friday Harbor Sand & Gravel	Box 1051 Main St. Vancouver 4, B.C. Canada	do	San Juan.
Glacier Sand & Gravel Co	5975 E. Marginal Way Seattle, Wash. 98134	do	King, Pierce.
Klineline Sand & Gravel Co	1508 N.E. 117th St. Vancouver, Wash. 98665	do	Clark.
Lakeside Gravel Co., Inc	Box 7 Bellevue, Wash. 98004	do	King.
Miles Sand & Gravel	Box 130 Auburn, Wash. 98002	do	Do.
North Kitsap Gravel Asphalt Co.[2]	Rt. 2, Box 700 Poulsbo, Wash. 98370	do	Kitsap.
Olympia Oil & Wood	P.O. Box 27 Olympia, Wash. 98507	do	Thurston.
Pacific Sand & Gravel Co	Box 699 Centralia, Wash. 98531	do	Lewis.
Quigg Bros. McDonald, Inc	P.O. Box 480 Hoquiam, Wash. 98550	do	Grays Harbor.
Reid Sand & Gravel Co	Box 922 Bellevue, Wash. 98009	do	King.
Stoneway Concrete, Inc	Box 509 Renton, Wash. 98055	do	Do.
D. A. Sullivan Co.[3]	Parkwater Station, Box 37 Spokane, Wash. 99211	do	Various.
S & S Sand & Gravel Co.[3]	Box 1211 Ephrata, Wash. 98823	do	Do.
Ray Weist Construction Co.[1]	Box 191 Yakima, Wash. 98901	do	Yakima.
Woodworth & Co., Inc	1200 East D St. Tacoma, Wash. 98421	do	Pierce.
Yakima Cement Products Co	1202 S. First St. Yakima, Wash. 98901	do	Yakima.
Silicon carbide: The Carborundum Co	P.O. Box 423 Niagara Falls, N.Y. 14302	Plant	Clark.
Stone:			
Black River Quarry, Inc	6808 South 140th Seattle, Wash. 98178	Quarry	King.
Carl Carbon, Inc	Box 5153 N. Central Station Spokane, Wash. 99205	do	Spokane, Whitman.
Cascade Asphalt Paving Co.[3]	6328 S. Tacoma Way Tacoma, Wash. 98409	do	Pierce.
Columbia Cement Co	P.O. Box 37 Bellingham, Wash. 98225	do	Whatcom.
Crow Rock Products, Div. of Northwest Paving, Inc	Rte. 4, Box 347 Moscow, Idaho 83843	do	Whitman.
DeAtley Corp	Box 648 Lewiston, Idaho 83501	do	Various.
Degerstrom, N.A	Box 425 Spokane, Wash. 99210	do	Do.
Friend & Rikals, Inc	Box 3 Aberdeen, Wash. 98520	do	Grays Harbor.
General Construction Co	Box 3845 Seattle, Wash. 98124	Quarry and plant	Jefferson.
Interstate Asphalt Co., Inc	Box 208 Aberdeen, Wash. 98520	do	Kitsap.
Lehigh Portland Cement Co	718 Hamilton St. Allentown, Pa. 18105	do	Pend Oreille.
Lockheed Shipbuilding & Construction Co.	12020 E. Marginal Way Seattle, Wash. 98168	do	King.
Materne Bros	Box 0–Rosewood Station Spokane, Wash. 99208	do	Various.

See footnotes at end of table.

Table 8.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
NONMETALS—Continued			
Stone—Continued			
Monroe Quarry	Box 488 Monroe, Wash. 98272	Quarry and plant	Snohomish.
Stoen Construction Co	2210 E. 95th St. Seattle, Wash. 98115	do	Do.
D. A. Sullivan Co	Box 37, Parkwater Sta. Spokane, Wash. 99211	do	Spokane.
Weyerhaeuser Co	Longview, Wash. 98632	do	Cowlitz, Lewis, Pacific.
Sulfuric acid: American Smelting and Refining Co.	Box 1605 Tacoma, Wash. 98401	Smelter	Pierce.
Talc and soapstone: Western Minerals, Inc.	3314 Harbor Ave. S.W. Seattle, Wash. 98126	Quarry	Skagit.
Vermiculite (exfoliated): Vermiculite-Northwest, Inc.	P.O. Box A Auburn, Wash. 98002	Plant	Spokane.
METALS			
Aluminum:			
Aluminum Company of America	Vancouver, Wash. 98600	Reduction plant	Clark.
	Wenatchee, Wash. 98801	do	Chelan.
Intalco Aluminum Corp	Bellingham, Wash. 98225	do	Whatcom.
Kaiser Aluminum & Chemical Corp	Spokane, Wash. 99200	do	Spokane.
	Tacoma, Wash. 98400	do	Pierce.
Martin Marietta Aluminum Inc	Goldendale, Wash. 98632	do	Klickitat.
Reynolds Metals Co	Longview, Wash. 98632	do	Cowlitz.
Copper:			
American Smelting and Refining Co	Box 1605 Tacoma, Wash. 98401	Smelter	Pierce.
Pend Oreille Mines & Metals Co	923 Old National Bank Bldg. Spokane, Wash. 99201	Mine and mill	Pend Oreille.
Ferroalloys:			
Foote Mineral Co	Wenatchee, Wash. 98801	Plant	Douglas.
Ohio Ferro-Alloys Corp	Tacoma, Wash. 98400	do	Pierce.
Gold: Knob Hill Mines, Inc	160 Sansome St. San Francisco, Calif. 94104	Mine and mill	Ferry.
Lead-zinc: Pend Oreille Mines & Metals Co.	923 Old National Bank Bldg. Spokane, Wash. 99201	do	Pend Oreille.
Steel:			
Bethlehem Steel Co., Pacific Coast Div.	Seattle, Wash. 98124	Plant	King.
Northwest Steel Rolling Mills, Inc.	Seattle, Wash. 98107	do	Do.
Uranium: Dawn Mining Co	Box 25, Ford, Wash. 99013	Mine and mill	Stevens.
Zinc: American Smelting and Refining Co.	Wallace, Idaho 83873	do	Do.
MINERAL FUELS			
Coal:			
Black Prince Coal Co	Rt. 2, Box 59 Centralia, Wash. 98531	Mine	Lewis.
Palmer Coking Coal Co., Inc	P.O. Box 8 Black Diamond, Wash. 98010	do	King.
Peat:			
Cunningham Sand & Gravel Co., Inc.	N. 6315 Cedar St. Spokane, Wash. 99208	Bog	Spokane.
Kildow Brothers, Inc	Rt. 15, Box 550 Olympia, Wash. 98502	Bog	Thurston.
Maple Valley Humus	18805 S.E. 170th St. Renton, Wash. 98055	Bog	King.
Plant Food Co	14515 35th Ave. Bothell, Wash. 98011	Bog	Snohomish.
Petroleum refining:			
Atlantic Richfield Co	Ferndale, Wash. 98248	Refinery	Whatcom.
Mobil Oil Corp	do	do	Do.
Shell Oil Co	Anacortes, Wash. 98221	do	Skagit.
Sound Refining, Inc	Tacoma, Wash. 98400	do	Pierce.
Texaco, Inc	Anacortes, Wash. 98221	do	Skagit.
U.S. Oil & Refining Co	Tacoma, Wash. 98400	do	Pierce.

[1] Also clay.
[2] Also traprock.
[3] Also sand and gravel.

The Mineral Industry of West Virginia

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the West Virginia Geological and Economic Survey for collecting information on all minerals except fuels.

By R. E. Harris[1]

In 1972, West Virginia was the leading State in the Nation in the production of bituminous coal. Coal was responsible for 89% of the State's mineral output value. Coal production was 124 million tons, compared with 118 million tons in 1971. The value of total mineral output in the State rose $157 million, an increase of 11.2%.

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[1] Mining engineer, Division of Fossil Fuels—Mineral Supply.

Table 1.—Mineral production in West Virginia[1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays ---thousand short tons--	232	$336	[2]274	[2]$403
Coal (bituminous) ---do---	118,258	1,128,282	123,748	1,275,818
Gem stones ---	NA	2	NA	2
Lime ---thousand short tons--	197	3,073	W	W
Natural gas ---million cubic feet--	234,027	60,618	214,951	64,485
Petroleum (crude)---thousand 42-gallon barrels--	2,969	11,609	2,677	12,047
Salt ---thousand short tons--	1,174	4,778	1,232	5,963
Sand and gravel ---do---	7,107	16,756	5,765	15,031
Stone ---do---	9,880	[3]18,066	[3]11,649	[3]31,298
Value of items that cannot be disclosed: Cement, clay (kaolin), natural gas liquids, stone, and values indicated by symbol W --	XX	30,445	XX	35,595
Total ---	XX	1,273,960	XX	1,430,632
Total 1967 constant dollars ---	XX	1,083,248	XX	p1,190,143

p Preliminary. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Excludes fire clay; included with "Value of items that cannot be disclosed."

[3] Excludes dimension stone; included with "Value of items that cannot be disclosed."

Table 2.—Value of mineral production in West Virginia, by county[1]
(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Barbour ---	$25,171	$23,678	Coal.
Berkeley ---	W	W	Cement, stone, lime, clays.
Boone ---	35,972	W	Coal, natural gas liquids.
Braxton ---	W	W	Stone, coal.
Brooke ---	W	W	Coal, sand and gravel.
Cabell ---	W	W	Clays.
Clay ---	383	209	Coal.
Fayette ---	46,790	33,186	Coal, stone.
Gilmer ---	620	297	Coal.
Grant ---	14,523	W	Coal, stone.
Greenbrier ---	7,360	10,772	Do.
Hancock ---	W	W	Sand and gravel, clays.
Hardy ---	43	W	Stone.
Harrison ---	W	W	Coal, stone, sand and gravel.
Jackson ---	W	30	Stone.

See footnotes at end of table.

Table 2.—Value of mineral production in West Virginia, by county[1]—Continued

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Jefferson	W	W	Stone.
Kanawha	W	W	Coal, natural gas liquids, stone.
Lewis	W	W	Coal, stone.
Lincoln	W	W	Stone, clays.
Logan	$113,177	$110,883	Coal.
McDowell	192,372	216,122	Do.
Marion	54,983	62,920	Do.
Marshall	W	48,560	Coal, salt.
Mason	W	1,491	Coal.
Mercer	11,052	16,318	Coal, stone.
Mineral	W	W	Do.
Mingo	28,514	34,348	Do.
Monongalia	W	W	Do.
Monroe	W	W	Sand and gravel.
Morgan	W	W	Do.
Nicholas	W	60,959	Coal, stone, sand and gravel.
Ohio	W	19,988	Coal.
Pendleton	W	W	Stone, lime.
Pleasants	W	W	Sand and gravel.
Pocahontas	W	W	Stone.
Preston	W	W	Coal, stone.
Raleigh	W	95,535	Coal, stone, sand and gravel.
Randolph	W	W	Coal, stone.
Roane	W	--	
Taylor	W	W	Coal, clays.
Tucker	W	W	Coal, stone.
Tyler	W	W	Salt, sand and gravel.
Upshur	7,845	6,539	Coal.
Wayne	W	6,992	Coal natural gas liquids, stone.
Webster	1,622	1,025	Coal.
Wetzel	W	W	Natural gas liquids, sand and gravel.
Wirt	W	--	
Wood	2,525	W	Sand and gravel.
Wyoming	W	W	Coal, sand and gravel.
Undistributed[2]	680,505	665,787	
Total[3]	1,273,960	1,430,632	

W Withheld to avoid disclosing individual company confidential data; includued with "Undistributed."

[1] Calhoun, Doddridge, Hampshire, Putnam, Ritchie, and Summers Counties are not listed because no production was reported.

[2] Includes gem stones, natural gas, natural gas liquids (1971), petroleum, and values indicated by symbol W.

[3] Data may not add to totals shown because of independent rounding.

Table 3.—Indicators of West Virginia business activity

	1971	1972p	Change, percent
Employment and labor force, annual average:			
Total labor force .... thousands	647.5	657.3	+1.5
Unemployment .... do	44.5	45.5	+2.2
Employment:			
Manufacturing .... do	122.9	122.8	−0.1
Transportation and public utilities .... do	40.8	40.2	−1.5
Wholesale and retail trade .... do	96.5	101.7	+5.4
Finance, insurance, real estate .... do	15.9	16.5	+3.8
Mining .... do	48.1	53.1	+10.4
Services .... do	67.4	70.5	+4.6
Contract construction .... do	30.8	34.2	+10.4
Government .... do	98.0	98.3	+0.3
Payroll average weekly earnings: Manufacturing .... do	$179.39	$166.57	−7.2
Personal income:			
Total .... millions	$5,789	$6,365	+10.0
Per capita	$3,275	$3,574	+9.1
Construction activity: Cement shipments to and within West Virginia .... thousand short tons	672	593	−11.8
Mineral production value .... millions	$1,274.0	$1,430.6	+11.2

p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Area Trends in Employment and Unemployment; U.S. Bureau of Mines.

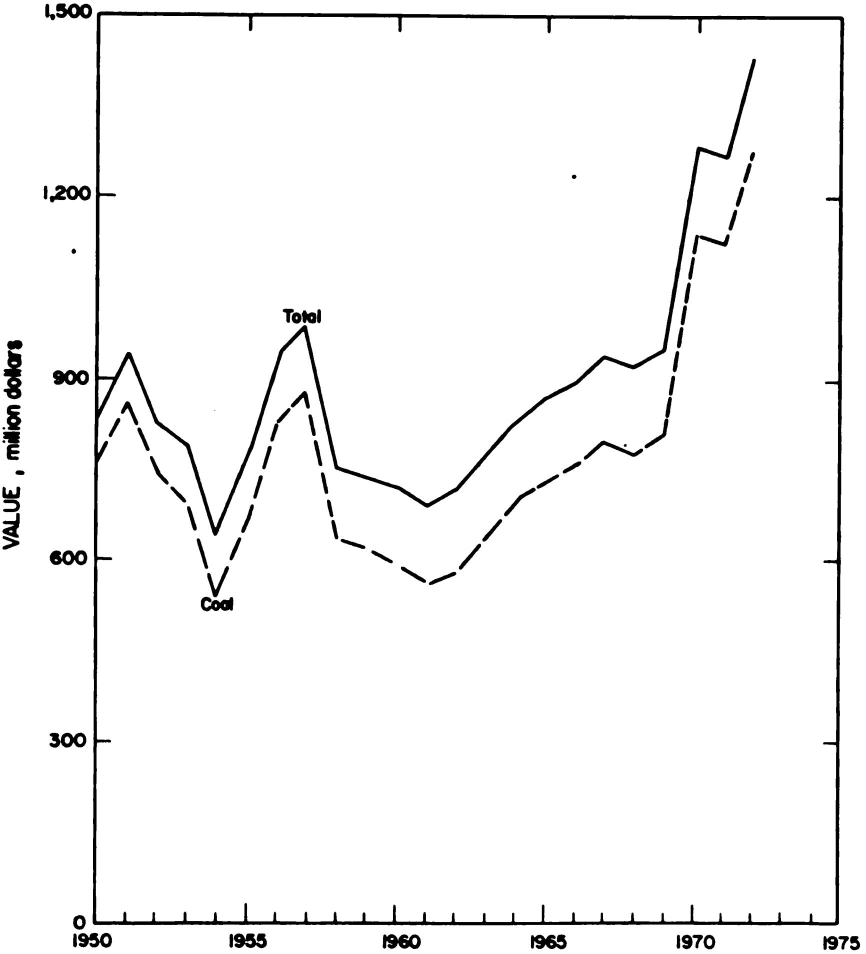

Figure 1.—Value of coal and total value of mineral production in West Virginia.

Legislation and Government Programs.—In July 1972, construction was started on the permanent site of the Federal Mine Health and Safety Academy near Beckley, Raleigh County. With completion sheduled for early 1975, this academy was expected eventually to train 600 Federal mine inspectors annually.

An authorized training program for West Virginia State mine inspectors was started by West Virginia University at Morgantown, Monongalia County. This program calls for 16 weeks of instruction at the university, and on-the-job training in the field with veteran mine inspectors for the remainder of the 1-year training period.

At the Bureau of Mines Morgantown Energy Research Center, research was completed, continued, or started on a number of projects. Among the completed projects were pneumatic transportation of coal, sampling stack gas emissions, lunar minerals, electrostatic dedusting and pyrite separation from coal in free fall, fracture orientation as related to gas storage reservoirs, assessment of the hazard potential of oil and gas formation on underground coal mines, and development and demonstration of technologies for safety plugging gas or oil wells intersecting coalbeds. Among the projects being continued were formcoke, corrosion of fireside surfaces in coal-fired boilers, utilization and processing of solid wastes from combustion and mining, use of heat pipes in fluid-bed coal gasification, SO^2 removal from stack gas, coal minerals and products, producer-gas cleanup and purification, pressurized gas producer, reactivity of chars in underground gasification, fluidized-bed gasification by hot recycled grog, oil and gas reservoir rock characteristics, increasing oil recovery from Appalachian oilfields by reservoir stimulation, factors affecting new oil recovery, and monitoring the plugging of wells for mining through safely. Among the newly started projects were underground gasification of coal, influence of coal minerals on energy production, subsurface management of waste liquids, and reactivity between limestone and hydrogen sulfide in producer gas.

The West Virginia Geological and Economic Survey continued their cooperative programs with the U.S. Geological Survey. An additional 39 new 7.5-minute topographic quadrangle maps were published, and 18 previously issued 7.5-minute topographic quadrangle maps were revised. Other continuing programs were ground-water investigations and data collection, river basin studies, and a salt water-fresh water interface study. The West Virginia Geological and Economic Survey continued its studies on the quantity and quality of the coal reserves in West Virginia. The Survey also continued collecting, cataloging, and filing well samples and geophysical logs from contributors. The cooperative shale and clay program with the Bureau of Mines was continued.

The West Virginia Department of Natural Resources located, mapped, and classified by degree of potential hazard (3 classes) 663 coal mine refuse piles for inclusion in a report requested and authorized by the State Legislature.

Two studies, funded by Bureau of Mines grants, were started on the problem of methane gas in underground mines. One study involved a computerized system of monitoring conditions within coal mines, and the other involved methods of draining methane gas through special drainage wells.

Trends and Developments.—Approximately 80 tons of sludge from an experimental mine water treatment plant in Monongalia County was used in an experimental parking area paving project at the Dulles International Airport in Virginia for the Transpo II exposition.

The Federal No. 2 mine, operated by the Eastern Associated Coal Corp. in Monongalia County, initiated the first loading of a wholly utility-owned (Detroit Edison) unit train.

On February 26, a coal refuse dam of the Buffalo Mining Company in Logan County failed and flooded Buffalo Creek Valley, resulting in the death of 118 persons and millions of dollars in damages. As a result of this disaster, both Federal and State inspections and studies of other coal refuse dams and piles were started.

Prosecutions for violations of the West Virginia surface mining law increased over the 1971 prosecutions. Also increasing were the number of Federal court suits filed against coal operators for failure to pay fines assessed for violations of the Federal Coal Mine Health and Safety Act of 1969, and the number of fines for water pollution.

At yearend, the Mountainer Coal Co. Division of Consolidation Coal Co. had five acid mine water treatment plants in operation in the northern section of the State. These plants were treating a total of approximately 2.6 million gallons of acid mine water daily.

Employment and Injuries.—According to the West Virginia Coal Association annual report, coal mining employment totaled 46,500 at yearend 1972. This was a decrease of 3,900 from 1971 employment. This employment loss was caused mostly by mine closures or cut backs in mine personnel. Although West Virginia led the Nation in coal mine fatalities with 48, the rate of coal mine fatalities dropped to its lowest level since the late 1920's. The 1972 ratio was 0.62 fatal accidents per million man-hours worked. The 1971 ratio was 0.73.

On July 22, a mine fire at the Blacksville No. 1 mine, Monongalia County, resulted in the death of nine trapped miners. On December 15, four gas explosions at a coke plant of the Weirton Steel Co., Hancock County, killed 19 men and in-

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	43,824	217	9,530	75,524	40	4,736	63.24	NA
Nonmetal	161	229	37	293	--	4	13.64	317
Sand and gravel	287	222	64	698	--	22	31.51	1,431
Stone	1,315	248	326	2,661	2	58	22.55	6,282
Total	45,587	218	[1] 9,956	79,176	42	4,820	61.41	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Nonmetal	160	259	42	333	--	1	3.01	21
Sand and gravel	165	246	41	417	--	8	19.17	774
Stone	1,125	266	300	2,450	2	37	15.92	5,211
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data does not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

jured 10 others. On December 16, a methane gas explosion at the Itmann No. 3 mine, Wyoming County, killed five men and injured three others.

REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Carbon Black.—Carbon black was produced at two furnace process plants, one each in Marshall and Pleasants Counties. The production of carbon black increased 99.1% over that of 1971. The total value of this production increased 96.9% over the 1971 value. Carbon black was mostly used by the rubber industry and in the manufacture of ink.

Coal (Bituminous).—West Virginia, after losing its position in 1971 as the leading coal-producing State in the Nation, regained the top spot in 1972. The 1972 production was 124 million short tons, an increase of 6 million short tons or 4.6% when compared with the 118 million short tons produced in 1971. The total value of the 1972 coal production increased $147 million or 13.0% when compared with the 1971 total value.

Each of the following five counties, listed in descending order, produced more than 10 million short tons in 1972: McDowell, Monongalia, Wyoming, Boone, and Kanawha. Leaders in production from underground mines were McDowell, Monongalia, and Wyoming Counties. Leaders in production from strip mines were Kanawha, Barbour, and Boone Counties. Leaders in production from auger mines were Kanawha, Logan, and Mingo Counties. The largest coal-producing mine in the State was the Humphrey No. 7 Christopher Coal Co., Div., Consolidation Coal Co. mine in Monongalia County. There were 21 mines, all underground, that had individual productions of over 1 million tons.

The production of open-market coal totaled 116.5 million short tons valued at $1,179 million, an increase of 11.5 million tons or 11% in quantity and an increase of $226 million or 23.7% in value when compared with the 1971 quantity and value. The production of captive coal totaled 7.2 million short tons valued at $97 million, a decrease of 6 million tons or 45.5% in quantity and a decrease of $78 million or 44.6% in value when compared with the 1971 quantity and value. The average value per ton of coal rose to $10.31 in 1972 from $9.54 in 1971, an increase of 8.1%.

There were 935 active mines in 1972, each mine having a production of 1,000 tons or more. This was a decrease of 115 mines or 11% when compared with the active mines in 1971. All methods of mining—underground, strip, and auger—had declines in the number of active mines. However, the total production by underground mining methods increased over that of 1971, whereas, each of the other mining methods—strip and auger—had less total production than they had in 1971. Of the total number of mines, 548 or 58.6% were underground, 288 or 30.8% were strip, and 99 or 10.6% were auger. Of the total output, 101.7 million tons or 82.2% were produced from underground mines, 19.1 million tons or 15.4% were from strip mines, and 3.0 million tons or 2.4% were from auger mines. The value of coal produced was $1,108 million from underground mines, an increase of 19.1% over the 1971 value; $144 million from strip mines, a decrease of 11.7% from the 1971 value; and $24 million from auger mines, a decrease of 31.4% from the 1971 value.

Equipment used at underground mines included 551 cutting machines, 30 less than in 1971; 330 hand-held and/or post-mounted coal drills, 132 less than in 1971; 316 mobile coal drills, an increase of 78 over that of 1971; 789 rotary rock drills, 35 more than in 1971; and 185 percussion rock drills, 23 less than in 1971. Over 33 million short tons was cut by cutting machines, and 434,000 short tons was cut by hand or shot from the solid. Of the total coal drilled underground, 11 million tons was drilled by hand-held or post-mounted drills, and 23 million tons was drilled by mobile drills.

Equipment used at strip mines included 304 power shovels, 129 less than in 1971; 33 draglines, 2 less than in 1971; 20 carryall scrapers, 7 more than in 1971; 513 bulldozers, 47 more than in 1971; 48 horizontal power drills, 2 more than in 1971; 131 vertical power drills, 14 more than in 1971; 1310 front-end loaders, 41 more than in 1971; 23 power brooms, 13 more than in 1971; 78 motor graders, 12 more than in 1971; and 29 coal drills, 4 more than in 1971.

Table 5.—West Virginia: Coal (bituminous) production

(Thousand short tons and thousand dollars)

Year	Quantity	Value
1968	145,921	775,720
1969	141,011	807,811
1970	144,072	1,142,245
1971	118,258	1,128,282
1972	123,743	1,275,813

Equipment used at auger mines included 89 augers, 33 fewer than in 1971; 1 power shovel, no change from 1971; 77 bulldozers, 5 less than in 1971; 6 power drills, 2 more than in 1971; 28 front-end loaders, 6 more than in 1971; and 6 motor graders, 1 more than in 1971.

Of the total underground production, more than 99%, a slight increase over the 1971 percentage, was mechanically loaded. Continuous-mining machines produced 65.3 million tons or 64.8% of the coal mechanically loaded. This was an increase of 8.0 million tons or 14% over that of 1971. Mobile loading machines produced 32.3 million tons or 32.1% of the coal mechanically loaded. This was an increase of 1.1 million tons or 3.5% over that of 1971. The remainder of the coal mechanically loaded, 3.1 million tons or 3.1%, was produced by longwall machines. This was an increase of 0.6 million tons or 24% over that of 1971. The 685 continuous-mining machines, 4 more than were in use in 1971, were reportedly used as follows: 431 loaded into shuttle cars or rubber-tired mine cars; 73 loaded onto conveyors or into mine cars; and 181 deposited coal directly onto the mine bottom. The 753 mobile loading machines, 43 more than were in use in 1971, were reportedly used as follows: 510 loaded into shuttle cars or rubber-tired mine cars; 62 loaded onto conveyors or into mine cars; and 181 were used in conjunction with continuous-mining machines for loading that coal deposited directly onto the mine bottom. Of the 15 longwall machines in operation, 1 more than in use in 1971, 10 machines were typed as planers and 5 machines were typed as shearers. The planers were responsible for 71% of the longwall production and the shearers accounted for the remaining 29% of the longwall production.

In 1972, 136 cleaning plants, 6 less than in 1971, produced 83.3 million tons of cleaned coal. This was 67.3% of the total coal production and 1.7% less than the percentage cleaned in 1971. Of the total amount of cleaned coal, 24.7% was produced by jigs; 44.7% was produced by dense-medium processes; 19.3% was produced by concentrating tables; 7.4% was produced by froth flotation; 2.5% was produced by pneumatic methods; and the remaining 1.4% was produced by classifiers. The cleaned coal, recovered from these cleaning devices, totaled 71.5% of the raw coal input into these same devices. In 1972, the average recovery percentages, by method of cleaning for the State as a whole, were as follows: jigs averaged 76.7%; dense-medium processes averaged 69.9%; concentrating tables aver-

Table 6.—West Virginia: Bituminous coal production, by type of mine and county
(Excludes mines producing less than 1,000 short tons annually)

County	Number of mines				Production (thousand short tons)				Value (thousands)
	Underground	Strip	Auger	Total	Underground	Strip	Auger	Total	
Barbour	12	17	2	31	1,306	2,427	89	3,822	$33,673
Boone	40	21	14	75	8,852	1,676	280	10,808	98,062
Braxton	1	--	--	1	2	--	--	2	13
Brooke	2	6	1	9	682	209	10	901	7,100
Clay	1	1	--	2	25	4	--	29	209
Fayette	24	13	6	43	2,868	587	47	3,502	38,092
Gilmer	--	1	--	1	--	49	--	49	297
Grant	3	8	--	11	1,314	487	--	1,801	12,186
Greenbrier	4	12	--	16	106	451	--	557	6,761
Harrison	10	18	3	31	3,971	1,267	94	5,332	40,428
Kanawha	41	23	25	89	6,961	2,689	1,025	10,675	92,518
Lewis	--	7	1	8	--	264	60	324	2,235
Logan	55	12	14	81	8,449	778	589	9,766	110,883
McDowell	109	17	4	130	13,336	809	53	14,198	216,122
Marion	7	3	--	10	7,135	89	--	7,224	62,920
Marshall	4	--	--	4	6,389	--	--	6,389	43,987
Mason	1	--	--	1	181	--	--	181	1,491
Mercer	4	3	2	9	1,023	57	34	1,114	15,768
Mineral	1	5	--	6	106	233	--	339	1,891
Mingo	32	11	10	53	2,604	740	439	3,783	34,310
Monongalia	17	12	--	29	11,918	611	--	12,529	95,268
Nicholas	40	18	5	63	4,625	1,324	74	6,023	60,872
Ohio	2	--	--	2	2,204	--	--	2,204	19,968
Preston	12	26	--	38	696	829	--	1,525	9,283
Raleigh	30	13	6	49	5,503	1,113	186	6,802	95,168
Randolph	9	11	--	20	249	673	--	922	7,110
Taylor	--	5	--	5	--	280	--	280	1,957
Tucker	--	2	--	2	--	146	--	146	1,607
Upshur	5	10	--	15	286	636	--	922	6,539
Wayne	2	--	--	2	376	--	--	376	3,479
Webster	9	3	1	13	95	17	3	115	1,025
Wyoming	71	10	5	86	10,400	654	47	11,101	154,564
Total[1]	548	288	99	935	101,662	19,101	2,979	123,743	1,275,813

[1] Data may not add to totals shown because of independent rounding.

aged 71.1%; froth flotation averaged 66.2%; pneumatic methods averaged 72.7%; and classifiers averaged 73.6%. Of the total amount cleaned, 32% was dried in 54 thermal drying plants.

Of the total production, 91.4% was shipped by either rail or water; the remainder was shipped by truck or other methods. Of the total production, 27% was shipped by unit train.

In 1972, according to the West Virginia Surface Mining and Reclamation Association, West Virginia was again the leading State in the Nation in reclaiming lands that had been surfaced mined for coal with a reclamation acreage of 27,332 acres. This was an increase of 6,963 acres of 34.2% over the 1971 reclamation acreage.

Coke and Coal Chemicals.—The production of coke at three oven-coke plants, one each in Brooke, Hancock, and Marion Counties, was slightly more than 3.5 million tons, compared with slightly over 3.0 million in 1971. When compared with 1971 values, the total value of the coke increased approximately $20.1 million, and the average value per ton decreased 2 cents.

At these three oven-coke plants, 4.8 million tons of coal (0.3 million tons more than the 1971 total) was carbonized with a coke-yield of 72.7% per ton. Of the total amount of coal supplied to these plants, 2.8 million tons or 55.6% was from Pennsylvania, 1.9 million tons or 39.0% was from West Virginia, and the remaining 300,000 tons or 5.4% was from Kentucky and Virginia.

A total of 268,000 tons of coke breeze was recovered at the oven-coke plants. Coal-chemical materials, exclusive of coke breeze, produced at the oven-coke plants included 40.5 million gallons of coke-oven tar, 53.6 billion cubic feet of coke-oven gas, 41,000 tons of ammonium sulfate, and crude light oil from which benzene, toluene, xylene, and solvent naphtha were recovered.

Natural Gas Light.—The quantity produced and the total value of natural gas liquids decreased 5.1% and 5.9%, respectively, when compared with 1971 production and value. The proved reserves of natural gas liquids at yearend were 82.1 million 42 gallon barrels, 179,000 barrels less than the reserves at yearend 1971.[2]

Petroleum and Natural Gas.—The production of crude oil in 1972 totaled slightly less than 2.7 million barrels, a decrease of almost 300,000 barrels or 9.8% from 1971 production. The total value of this production increased $438,000 or 3.8% when compared with the 1971 total value. The average price paid for Penn-grade crude in West Virginia was $4.50 per barrel, an increase of 59 cents or 15.1% per barrel over the 1971 average price.

Natural gas production was 214,951 million cubic feet, a decrease of slightly more than 19 million cubic feet or 8.2% from that of 1971. The total value of the natural gas production was $64.5, an increase of almost $3.9 million or 6.4% over that of 1971. The average wellhead value for natural gas (includes the value of natural gas liquids contained therein) was 30.0 cents per thousand cubic feet, an increase of 4.1 cents or 15.8% per thousand cubic feet over the 1971 wellhead value.

The estimated number of producing wells in the State at yearend was 33,460 wells. Of this total, there were 12,136 oil wells, an increase of 24 wells or 0.2% over that of 1971, and 21,324 gas wells, an increase of 299 wells or 1.4% over that of 1971.

According to the American Petroleum Institute, in 1972 there were 674 well completions, of which 591 were development wells and 83 were exploratory wells. When compared with 1971 well completions, development well completions decreased by 111 and exploratory well completions increased by 18. In 1972, 536 or 90.7% of the development wells were successful, and 36 or 43.4% of the exploratory wells were successful. Successful percentages in 1971 were 86.9% and 28.8%, respectively. The total footage drilled in completing these wells was 2,097,812 feet, a decrease of slightly more than 250,000 feet or 10.7%. Well completions were reported in 39 counties; the three leading counties, in descending order by number of wells, were Ritchie, Gilmer, and Lewis. On a footage drilled basis, the three leading counties, in decreasing order by number of feet, were Lewis, Barbour, and Upshur. Ritchie County led the State in the number of development well completions, and Jackson County led in the number of exploratory well completions.

The Oil and Gas Division of the West Virginia Department of Mines issued 832 permits (6 less than in 1971) to drill new wells or deepen old wells and 131 permits (5 more than in 1971) to fracture old wells. Walton was again the most active oilfield, and Murphy Creek (Freemansburg) was the most active gasfield. Exploratory wells included 34 wildcat wells, of which 12 were successful; 13 deeperpool test wells, of which 5 were successful; 35 outpost wells, of which 17 were successful; and 1 successful shallow-pool test well. Of the exploratory successes, 60% were in shallow formations. There were six new-field discoveries in shallow formations and four new-field discoveries in deep formations. The average footage per exploratory well was 4,482 feet. Shallow wells accounted for 91.3% (5% more than in 1971) of all well completions reported. The Mississippian Big Injun interval again dominated shallow drilling with 269 completions, a decrease of 94 completions from that of 1971. Other leading intervals were the Upper Devonian Benson-Riley with 179 completions, an increase of 67 completions over that of 1971, and the Lower Mississippian Weir-Berea with 160 completions, a decrease of 32 completions from that of 1971. While deep drilling activity decreased during 1972, the Upper Silurian-Williamsport (Newburg) interval and the Huntersville-Oriskany interval continued to be the main target areas.

According to the Oil and Gas Journal, the estimated proved crude oil reserves at yearend were 34.0 million barrels, a decrease of 17.7 million barrels or 34.2% from reserves at yearend 1971. The estimated proved reserves of natural gas at yearend were 2,346 billion cubic feet, a decrease of 66 billion cubic feet or 2.7% from yearend reserves.[3]

According to the American Gas Association, at yearend the State had an underground gas storage capacity of 436,742 million cubic feet, an increase of 14,181 million cubic feet or 3.4% over that of 1971. At yearend, there were 350,903 million cubic feet of gas in storage, a decrease of 41,823 million cubic feet or a 10.6% decrease from that of 1971.[4] According to the West Virginia Geological and Economic Survey, 24 gas storage wells were completed during 1972.

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[2] Oil and Gas Journal. U.S. reserves skid again. Both oil and gas down sharply. V. 71, No. 13, Mar. 26, 1973, p.64.

[3] Pages 52 and 53 of work cited in footnote 2.

A deep test well, started in September 1971 by the Columbia Gas Transmission Corp. in Mingo County, became the deepest well drilled in West Virginia and the northeastern United States when it reached a depth of roughly 19,500 feet in December 1972.

At yearend, the West Virginia Geological and Economic Survey reported that a total of 3,522,000 undeveloped acres in the State were under lease by 13 large companies. In addition, Exxon had deep acreage rights involving more than 2 million acres. Additional acreage was under lease by independent operators and lease brokers.

The Big Injun waterflood in the Granny Creek-Stockly field in Clay County remained the only full-scale waterflood project in operation. One of the five pilot waterflood projects ceased operations early in 1972 leaving only four active at yearend. These secondary recovery projects were estimated to be responsible for 20% of the oil production in the State.

NONMETALS

Cement.—In 1972 shipments of portland cement increased 4.6%, and shipments of masonry cement increased 20% when compared with 1971 shipments. The total value of portland cement shipments increased by 12.4% and the total value of masonry cement shipments increased 30.1% when compared with 1971 total values. The average price per short ton for portland cement increased by 7.2%, and the average price per short ton for masonry cement increased by 9.3% when compared with the 1971 average prices. Martin Marietta Cement Eastern Division, at Martinsburg, Berkeley County, was the sole producer and operated three coal-fired rotary kilns. Most of the portland cement was used in ready-mix concrete, concrete product manufacture, and building and highway construction.

Clays.—The production of miscellaneous clays increased 18.1% over that of 1971 and the production of fire clays increased 21.4%. The total value of the miscellaneous clays increased 19.9%, and the total value of the fire clays increased 188.7% over 1971 values. The average value per ton for miscellaneous clays increased 1.4% and the average value per ton for fire clays increased 137.6% over 1971 average values. These clays were produced in five counties at seven operating mines (five open pit mines and two deep mines). Berkeley County continued to be the leading producer of miscellaneous clays, Hancock County remained the only producer of fire clays. Miscellaneous clays were chiefly used in the manufacture of cement and building brick. Fire clays were mostly used for producing firebrick and block.

Lime.—Lime production and the total value of this production both decreased when compared with 1971 production and value. The average price per ton decreased 7.5%. Two lime plants, one each in Berkley and Pendleton Counties, were in production in 1972. Lime was used for steel production, acid mine water neutralization, agriculture, and other uses. This lime production was mostly consumed in Maryland, Pennsylvania, and West Virginia. The total consumption of lime in West Virginia was 343,500 short tons, a decrease of 8.2% from 1971 consumption.

Salt.—Production of salt was 1,232,000 short tons, an increase of 58,000 short tons or 4.9% over that of 1971. The total value of this production increased 24.8%; the average value per ton increased by 77 cents or 18.9%. The salt was used by the producers in the manufacture of chlorine and caustic soda. The salt was produced from brines that were obtained from three active deep well solution mining operations in Marshall and Tyler Counties.

Sand and Gravel.—The output of sand was 3,638,000 short tons, a decrease of 12.2% from 1971 output. The output of gravel was 2,126,000 short tons, a decrease of 28.3% from that of 1971. The total value of the sand decreased by 2.6%; the total value of the gravel decreased by 28.8% from 1971 values. The average value per ton for sand increased by 10.8%; the average value per ton for gravel decreased by 0.6% from those of 1971. Of the total output, 63% was sand and 37% gravel. About 66% was shipped by barge with the balance being shipped by railroad or truck.

Production was reported from 12 counties with the three leading counties, in descending order by quantity produced, being Han-

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[4] American Gas Association. 1972 Annual Report. Pp. 8 and 11.

Table 7.—West Virginia: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Commercial operations				
Sand:				
Building	2,124	3,526	1,772	2,938
Fill	54	84	W	W
Paving	576	984	415	687
Other uses [1]	1,391	7,257	1,451	7,914
Total [2]	4,145	11,851	3,638	11,539
Gravel:				
Building	1,505	2,685	1,200	2,102
Fill	50	76	W	W
Other uses [3]	1,409	2,145	926	1,390
Total [2]	2,964	4,906	2,126	3,491
Total sand and gravel [2]	7,107	16,756	5,765	15,031

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes blast, engine, filtration, fire or furnace, glass, grinding and polishing, molding, abrasives, chemical, enamel, filler, foundry, pottery, porcelain, tile, and other sands.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes fill, paving, and railroad ballast.

Table 8.—West Virginia: Crushed and broken stone sold or used by producers, by use

(Thousand short tons and thousand dollars)

Use	1971 Quantity	1971 Value	1972 Quantity	1972 Value
Bituminous aggregate	801	1,425	170	351
Concrete aggregate	528	995	903	1,787
Dense graded roadbase stone	890	1,787	2,314	4,596
Surface treatment aggregate	648	1,214	979	1,672
Unspecified aggregate and roadstone	1,259	2,076	1,848	3,240
Abrasives	W	W	27	73
Agricultural purposes	93	222	75	168
Lime manufacture	251	500	435	849
Mine dusting	227	880	206	826
Railroad ballast	779	1,022	644	816
Refractory stone	72	205	39	89
Other uses [1]	4,338	7,790	4,012	6,829
Total [2]	9,880	18,066	11,649	21,293

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes dead-burned dolomite, stone used in cement and glass manufacture, riprap, stone sand, chemical and flux stone, filter stone (1971), dam construction (1972), and uses not specified.

[2] Data may not add to totals shown because of independent rounding.

cock, Morgan, and Monroe. Production was reported from 11 stationary plants, 1 portable plant, and 1 dredge.

Slag.—Weirton Steel Division, National Steel Corp., produced crushed air-cooled blast furnace slag for aggregate use.

Stone.—The total crushed stone (limestone and sandstone) production was 11,649,000 short tons, an increase of 17.9% over that of 1971. The total value of this production was $21.3 million, an increase of 17.9% over that of 1971. The average value per ton remained the same as in 1971. The crushed limestone output increased 16.3% and crushed sandstone output increased 40.9% from 1971 outputs.

Limestone production was reported from 14 counties and 33 quarries. The four leading limestone-producing counties, in descending order, by quantity produced, were Berkeley, Greenbrier, Monongalia, and Jefferson. The major uses for the limestone were roadbase stone, cement manufacture, various aggregates, flux for iron and steel production, railroad ballast, lime manufacture, and mine dusting.

Sandstone production was reported from 15 counties and 18 quarries. The four leading sandstone producing counties, in descending order, by quantity produced, were Harrison, Raleigh, Monongalia, and Lewis. The major uses for the crushed sandstone were various aggregates and roadbase stone.

The production of dimension stone and its total value remained the same as in 1971. The principal uses of dimension stone were cut stone and curbing.

Of the total stone production, 54.6% was shipped by truck, 33.7% was shipped by railroad, and the remainder was shipped by other means of transportation.

METALS

Aluminum.—The production of aluminum from alumina, at the Kaiser Aluminum & compound Chemical Corp. smelter in Ravenswood, Jackson County, and the total value of this production both decreased from 1971 production and value. However, in September 1972, the company reactivated a potline that had been idled during the latter part of 1971. This reactivation and other plant changes are expected to increase the operating rate of capacity from 82% to 88%. Imported bauxite was processed into alumina at Baton Rouge and Gramercy, La., and transported by rail to Ravenswood for smelting.

Ferroalloys.—The total production of all types of ferroalloys was 195,043 short tons in 1972. The total value of this production was $50,083,000. These ferroalloys were produced by three companies. The Union Carbide Corp. operated a plant near Alloy, Fayette County, where ferroalloys were produced in electric furnaces. Foote Mineral Co., Inc., also used electric furnaces to produce ferroalloys at their plant at Graham Station, Mason County. The Chemetals Division, Diamond-Shamrock Corp. used electric furnaces in producing ferromanganese at its plant near Kingwood, Preston County. Most mineral raw materials for these plants were obtained from other States or were imported.

Magnesium Compounds.—American Specialty Metals Division, American Metal Climax, Inc., produced anhydrous magnesium chloride at its plant near Parkersburg, Wood County.

Nickel.—Huntington Alloy Products Division, International Nickel Products Co., Inc., produced nickel and various types of high-nickel alloys at its plant at Huntington, Cabell and Wayne Counties. The principal products included nickel and high-nickel alloys in mill form such as strip, sheet, plate, tube, and wire rod, and bar and welding products, such as nickel and high-nickel bare welding filler wire, coated electrodes, and welding fluxes.

Zinc.—The zinc smelter at Meadowbrook, Harrison County, resumed operations in March 1972 after the plant was acquired by new owners, Meadowbrook Corp. Initial production was zinc dust but other plant products are zinc alloys, zinc oxides, and other zinc products. This plant uses zinc drosses, zinc ashes, and various zinc residues as raw materials.

Zirconium and Hafnium.—Amax Specialty Metals, Inc., produced zirconium sponge metal from zircon sands at its plant near Parkersburg, Wood County. Hafnium sponge metal was also produced at this plant. Corhart Refractories Inc. made zircon bricks at its plant near Buckhannon, Upshur County. Union Carbide Corp. produced zirconium metal powder and zirconium alloys at its plant at Alloy, Fayette County.

Table 9.—Principal producers

Commodity and company	Address	Type of activity	County
Cement (portland and masonry):			
Martin-Marietta Cement Eastern Div.[1]	Box 5618 Baltimore, Md. 21210	Plant	Berkeley.
Clays:			
Fire clay:			
Crescent Brick Co., Inc.	Box 368 New Cumberland, W. Va. 26047	Underground	Hancock.
Globe Refractories, Inc.	Box D Newell, W. Va. 26050	do	Do.
Common clay and shale:			
Barboursville Clay Manufacturing Co.	Box 1048 Charleston, W. Va. 25324	Pit	Cabell.
Continental Clay Products Co.	931 Investment Bldg. 1511 K St., N.W. Washington, D.C. 20005	Pit	Berkeley.
Sanders Dummy Co	Midkiff, W. Va. 25540	Pit	Lincoln.

See footnotes at end of table.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Coal (bituminous):			
Amherst Coal Co	Lundale, W. Va. 25631	Underground and auger.	Logan.
Do	do	Auger	Wyoming.
Bethlehem Mines Corp	701 East 3d St. Bethlehem, Pa. 18015	Underground	Boone, Kanawha, Marion.
Do	do	Underground, strip, and auger.	Raleigh.
Buffalo Mining Co	Lyburn, W. Va. 25632	do	Logan and Wyoming.
Eastern Associated Coal Corp.	Koppers Bldg. Pittsburgh, Pa. 15219	Underground	Boone, Marion, McDowell, Monongalia, Wyoming.
Island Creek Coal Co	Holden, W. Va. 25625	do	Boone, Grant, Logan, Marion, Monongalia, Nicholas, Raleigh, Wyoming.
King Knob Coal Co	Box 268 Clarksburg, W. Va. 26301	Strip	Barbour, Harrison, Marion, Monongalia.
Pocahontas Fuel Co., Div. of Consolidation Coal Co.	Pocahontas, Va. 24635	Underground	Mercer and Wyoming.
Do	do	Underground and strip.	McDowell.
Ranger Fuel Corp	Drawer V Beckley, W. Va. 25801	Strip and auger.	Boone.
Do	do	Underground and strip.	Raleigh and Wyoming.
Rowland Coal Co., Division of Consolidation Coal Co.	Box 169 Beckley, W. Va. 25801	Underground, strip, and auger.	Raleigh.
Semet-Solvay Div. Allied Chemical Corp.	40 Rector St. New York, N.Y. 10006	Underground	Fayette, McDowell, Wyoming.
The Valley Camp Coal Co	Shrewsbury, W. Va. 25184	Underground and strip.	Kanawha.
Do	Box 218 Triadelphia, W. Va. 26059	Underground	Ohio and Marshall.
The Youngstown Mines Corp.	Box 900 Youngstown, Ohio 44501	do	Logan.
Union Carbide Corp., Ferroalloys.	Box 38 Mammoth, W. Va. 25132	do	Kanawha and Mason.
United States Steel Corp	525 William Penn Place Pittsburgh, Pa. 15219	Underground and strip.	McDowell, Mingo, Wyoming.
Westmoreland Coal Co	123 South Broad St. Philadelphia, Pa. 19109	Underground	Boone and Nicholas.
Lime:			
Germany Valley Limestone Co., Div. of Greer Limestone Co.	Riverton, W. Va. 26814	Plant	Pendleton.
Jones & Laughlin Steel Corp., Blair Limestone Div.[2]	R.D. 3 Martinsburg, W. Va. 25401	do	Berkeley.
Magnesium Compounds:			
Amax Specialty Metals, Div. American Metal Climax Inc.	Box 1728 Parkersburg, W. Va. 26101	do	Wood.
Petroleum refineries:			
Pennzoil Co., Elk Refining Div.	Falling Rock, W. Va. 25079	do	Kanawha.
Quaker State Oil Refining Corp.	St. Marys, W. Va. 26170	do	Pleasants.
Do	Newell, W. Va. 26050	do	Hancock.
Salt:			
Industrial Chemicals Div. Allied Chemical Corp.	Box 70 Morristown, N.J. 07960	do	Marshall.
Inorganic Chemical Div. FMC Corp.	Box 8127 South Charleston, W. Va. 25303	Mine	Tyler.
PPG Industries, Inc., Chemical Div.	1 Gateway Center Pittsburgh, Pa. 15222	Plant	Marshall.

See footnotes at end of table.

Table 9.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel:			
Dravo Corp., Keystone Div.	5th and Liberty Ave. Pittsburgh, Pa. 15222	Dredge	Hancock.
Duquesne Sand Co	East Beaver St. Glenfield, Pa. 15115	do	Brooke.
Ohio River Sand & Gravel Div. of McDonough Co.	Box 538 Parkersburg, W. Va. 26100	Dredges	Pleasants, Tyler, Wetzel, Wood.
Pennsylvania Glass Sand Corp.	Berkeley Springs, W. Va. 25411	Pit	Morgan.
Pfaff & Smith Builders Supply Co.	Box 2508 Charleston, W. Va. 25329	Dredge	Wood.
Smelters:			
Kaiser Aluminum & Chemical Corp.	300 Lakeside Dr. Oakland, Calif. 94626	Plant	Jackson.
Meadowbrook Corp	One Wall Street New York, N.Y. 10005	do	Harrison.
Stone:			
Limestone (crushed and broken):			
Acme Limestone Co	Fort Spring, W. Va. 24936	Mine and quarry	Greenbrier.
Aurora Stone Co., Inc	Route 3 Keyser, W. Va. 26726	Quarry	Mineral.
Appalachian Stone Div., Martin-Marietta Corp.	Box 120 Mercersburg, Pa. 17236	do	Berkeley.
Elkins Limestone Co	Elkins, W. Va. 26241	Mine	Randolph.
The H. Frazier Co., Inc.	Box 1377 Richmond, Va. 23211	Quarry	Greenbrier.
Green Bag Cement Co., Div. of Marquette Cement Manufacturing Co.	20 North Wacker Dr. Chicago, Ill. 60606	Mine	Monongalia.
Greer Limestone Co	Greer Building Morgantown, W. Va. 26505	Mine and quarry	Monongalia and Pendleton.
Jones & Laughlin Steel Corp., Blair Limestone Div.	R.D. 3 Martinsburg, W. Va. 25401	Quarry	Jefferson.
Manheim Quarries, Inc.	P.O. Box 2187 Morgantown, W. Va. 26505	do	Preston.
U & L Steel	Rt. 3 Martinsburg, W. Va. 25401	do	Berkeley.
Sandstone (dimension):			
Rhine Creek Stone Co	Box 265 Eglon, W. Va. 26716	do	Preston.
Sandstone (crushed):			
Fairfax Sand & Crushed Stone Co.	Thomas, W. Va. 26292	do	Tucker.
Basil R. Hearner	French Creek, W. Va. 26218	do	Lewis.
Mazzella Quarries, Inc	2087 Oakridge Dr. Charleston, W. Va. 25311	do	Kanawha.
Meadows Stone & Paving, Inc.	Box 518 Gassaway, W. Va.	do	Braxton.
Raleigh Stone Co. of Beckley, W. Va.	Box 1387 Roanoke, Va. 24001	do	Raleigh.
Stone Co. Inc	5347 Route 60E Huntington, W. Va. 25705	do	Kanawha, Lincoln, Wayne.

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[1] Also limestone and shale.
[2] Also limestone.

The Mineral Industry of Wisconsin

This chapter has been prepared by the Bureau of Mines, U.S. Department of the Interior, and the Geological and Natural History Survey of Wisconsin, under a memorandum of understanding for collecting information on all minerals except coal and liquid fuels.

By Grace N. Broderick [1]

The mineral production of Wisconsin in 1972 was valued at $89.4 million, an increase of 6.3% over that of 1971. Sand and gravel and stone, $31.3 million and $29.7 million, respectively, accounted for 68.3% of the total.

Output of taconite pellets, produced by the Jackson County Iron Co., a subsidiary of Inland Steel Co., increased from 824,000 long tons in 1971 to 887,000 long tons in 1972. Production of 757 short tons of lead and 6,873 short tons of zinc, in terms of recoverable metal, represented a slight increase in lead production but a decrease of 35% in zinc production, as compared with 1971 figures. In terms of total value, lead production increased 10%, but zinc production decreased nearly 29%.

For the first time in inland navigation history, commercial shipping operations were extended between Lakes Superior and Michigan into February 1972.

In late 1971, the Port of Superior had its first shipment of fuels to overseas ports. A cargo of 3,800 tons of petroleum coke manufactured in Pine Bend, Minn., and 530 tons of Stott Briquets, manufactured in Superior, was loaded aboard a freighter destined for Preston, England. Traditionally, the Port of Superior has been a receiver of coal. This shipment opened the potential for shipment of low-sulfur Montana and Wyoming coals through the Upper Great Lakes port.

A bubbler system was being installed in the Superior Harbor by the U.S. Army Corps of Engineers as part of a 3-year study of extending the Great Lakes navigational shipping season. The system will en-

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[1] Physical scientist, Division of Ferrous Metals, Assistant Directorate—Mineral Supply.

Table 1.—Mineral production in Wisconsin [1]

Mineral	1971 Quantity	1971 Value (thousands)	1972 Quantity	1972 Value (thousands)
Clays .... thousand short tons	4	$8	4	$7
Gem stones	NA	W	NA	1
Iron ore (usable) .... thousand long tons, gross weight	824	W	887	W
Lead (recoverable content of ores, etc.) .... short tons	752	207	757	228
Lime .... thousand short tons	246	4,570	263	5,009
Peat .... do	2	153	2	179
Sand and gravel .... do	38,561	32,748	36,430	31,324
Stone .... do	15,568	25,105	19,394	29,681
Zinc (recoverable content of ores, etc.) .... short tons	10,645	3,428	6,873	2,440
Value of items that cannot be disclosed: Abrasive stone (1972), cement, gem stones (1971), and values indicated by symbol W	XX	17,817	XX	20,484
Total	XX	84,036	XX	89,353
Total 1967 constant dollars	XX	71,456	XX	p 74,333

p Preliminary. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." NA Not available. XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

able certain areas of the harbor to remain free from ice formations so that ships may pass. In addition, according to the Corps, the system will be used to test the chemical, physical, and biological effects on harbor waters stemming from the installation of the system; they are to be monitored at the demonstration site.

Base metals exploration was active in the northern part of Wisconsin. The International Minerals & Chemical Corp. of Libertyville, Ill., undertook geological, geochemical, and geophysical surveys and initiated diamond drilling on forest lands near Upson in Iron County. Duval Corp. conducted drilling operations in Marinette County.

North American Coal Corp. signed an option agreement with Michigan Wisconsin Pipe Line Co. dedicating 1.5 billion tons of lignite reserves in North Dakota to the pipeline company for future conversion into synthetic gas. The Michigan Wisconsin Pipe Line Co. supplies natural gas to Midwest markets (including Detroit and Milwaukee) and operates pipeline facilities totaling over 8,800 miles. The coal covered by the option agreement would provide gas equal to more than half of the current deliveries of the utility company. North American Coal Corp. retained the right to mine the coal, which would be converted to synthetic gas at plants to be built by Michigan Wisconsin Pipe Line Co. in the mine area.

Employment and Injuries.—Final statistics for 1971 on employment and injuries in the mineral industry and preliminary data for 1972 compiled by the Federal Bureau of Mines are given in table 4.

Table 2.—Value of mineral production in Wisconsin, by county [1]

(Thousands)

County	1971	1972	Minerals produced in 1972, in order of value
Adams	W	W	Sand and gravel.
Ashland	$220	W	Do.
Barron	480	W	Do.
Bayfield	W	$98	Do.
Brown	W	W	Stone, lime, sand and gravel.
Buffalo	W	W	Stone, sand and gravel.
Burnett	W	W	Sand and gravel, stone.
Calumet	W	W	Stone, sand and gravel.
Chippewa	316	335	Sand and gravel.
Clark	W	W	Sand and gravel, stone.
Columbia	2,132	2,519	Do.
Crawford	W	W	Stone, sand and gravel.
Dane	3,065	3,814	Do.
Dodge	W	W	Stone, sand and gravel, lime.
Door	W	W	Sand and gravel, stone.
Douglas	W	W	Lime, sand and gravel, stone.
Dunn	175	W	Sand and gravel, stone.
Eau Claire	W	W	Sand and gravel.
Florence	52	W	Do.
Fond du Lac	W	W	Stone, sand and gravel, lime, clays.
Forest	W	W	Sand and gravel.
Grant	2,019	W	Stone, sand and gravel.
Green	W	W	Do.
Green Lake	W	397	Sand and gravel, stone.
Iowa	332	418	Stone.
Iron	W	W	Sand and gravel.
Jackson	W	W	Iron ore, sand and gravel, stone.
Jefferson	W	W	Sand and gravel, stone.
Juneau	W	W	Stone, sand and gravel.
Kenosha	503	197	Sand and gravel.
Kewaunee	628	W	Sand and gravel, stone.
La Crosse	W	W	Stone, sand and gravel.
Lafayette	3,309	3,378	Zinc, stone, lead, sand and gravel.
Langlade	467	W	Sand and gravel.
Lincoln	468	477	Do.
Manitowoc	2,445	2,682	Cement, lime, sand and gravel, stone.
Marathon	3,066	3,967	Stone, sand and gravel.
Marinette	1,696	W	Do.
Marquette	W	322	Do.
Milwaukee	5,560	6,839	Cement, stone, sand and gravel.
Monroe	W	215	Stone, sand and gravel.
Oconto	W	W	Sand and gravel, stone.
Oneida	W	458	Sand and gravel.
Outagamie	W	W	Stone, sand and gravel.
Ozaukee	W	W	Sand and gravel, stone.
Pepin	W	W	Stone, sand and gravel.
Pierce	W	W	Do.

See footnotes at end of table.

Table 2.—Value of mineral production in Wisconsin, by county [1]—Continued
(Thousands)

County	1971	1972	Minerals produced in 1972, in order of value
Polk	W	$1,535	Stone, sand and gravel.
Portage	$447	691	Sand and gravel.
Price	W	W	Do.
Racine	W	3,240	Stone, sand and gravel, clays.
Richland	215	381	Stone, sand and gravel.
Rock	1,105	2,544	Sand and gravel, stone.
Rusk	W	331	Sand and gravel.
St. Croix	W	W	Stone, sand and gravel.
Sauk	1,419	1,442	Stone, sand and gravel, abrasive stone.
Sawyer	W	W	Sand and gravel.
Shawano	W	373	Sand and gravel, stone.
Sheboygan	W	419	Do.
Taylor	243	257	Sand and gravel.
Trempealeau	W	W	Stone, sand and gravel.
Vernon	481	W	Do.
Vilas	W	170	Sand and gravel.
Walworth	W	W	Sand and gravel, stone.
Washburn	W	1	Sand and gravel.
Washington	1,130	1,233	Sand and gravel, stone.
Waukesha	7,468	7,229	Stone, sand and gravel, peat.
Waupaca	W	186	Sand and gravel, stone.
Waushara	86	W	Sand and gravel.
Winnebago	2,481	2,242	Stone, sand and gravel.
Wood	187	198	Do.
Undistributed [2]	41,841	40,763	
Total	84,036	[3] 89,358	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] No production reported for Menominee County.

[2] Includes gem stones, quantities of sand and gravel, and stone that cannot be assigned to specific counties, and values indicated by symbol W.

[3] Data do not add to total shown because of independent rounding.

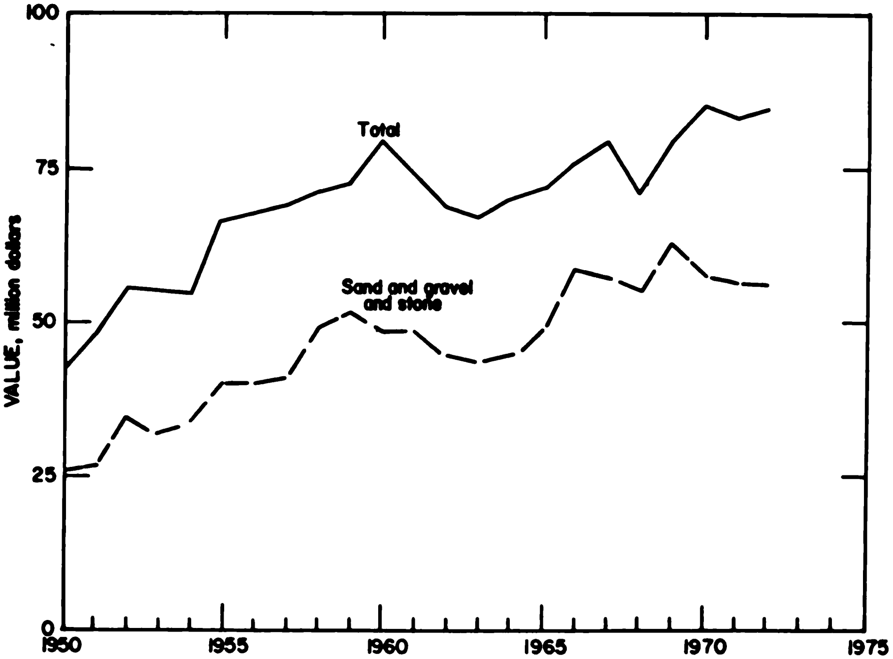

Figure 1.—Value of sand and gravel, stone, and total value of mineral production in Wisconsin.

Table 3.—Indicators of Wisconsin business activity

	1971	1972 [p]	Change, percent
Employment and labor force, annual average:			
Total labor force .... thousands..	1,930.0	1,973.4	+2.2
Unemployment .... do....	99.6	99.4	−.2
Employment:			
Manufacturing .... do....	479.6	498.6	+2.9
Construction .... do....	60.7	63.4	+4.4
Mining .... do....	2.5	2.5	--
Transportation and public utilities .... do....	80.6	81.7	+1.4
Wholesale and retail trade .... do....	332.1	346.0	+4.2
Finance, insurance and real estate .... do....	61.4	64.1	+4.4
Services .... do....	238.8	249.5	+4.7
Government .... do....	270.2	275.9	+2.1
Personal income:			
Total .... do....	$17,496.0	$19,014.0	+8.7
Per capita	$3,912.0	$4,207.0	+7.5
Construction activity:			
Value of authorized nonresidential construction .... millions..	$206.6	$284.4	+37.7
Number of private and public residential units authorized	31,991.0	30,727.0	−4.0
State highway commission contracts awarded .... millions..	$101.0	$154.0	+52.5
Portland cement shipments to and within Wisconsin thousand short tons..	1,579.0	1,619.0	+2.5
Farm marketing receipts .... millions..	$1,699.5	$1,906.9	+12.2
Mineral production value .... do....	$84.0	$89.4	+6.3
International trade: [1]			
Value of exports through Wisconsin .... do....	$251.3	$168.9	−32.8
Value of imports through Wisconsin .... do....	$147.2	$161.4	+9.6

[p] Preliminary.

[1] Includes Milwaukee Customs District.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trend in Employment and Unemployment; Roads and Street; U.S. Bureau of Mines; Highlights of U.S. Export and Import Trade.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Metal	245	269	66	527	--	12	22.75	595
Nonmetal	30	140	4	35	--	--	--	--
Sand and gravel	1,723	190	327	2,820	2	71	25.89	4,974
Stone	1,805	214	386	3,301	--	95	28.78	607
Total	3,803	206	783	6,683	2	178	26.93	2,445
1972: [1]								
Metal	190	329	62	498	--	14	28.13	816
Nonmetal	20	85	2	15	--	--	.00	--
Sand and gravel	1,165	165	192	1,638	1	51	31.74	4,710
Stone	1,390	188	262	2,227	--	61	27.39	674
Total	2,765	187	518	4,378	1	126	29.01	2,198

[1] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

REVIEW BY MINERAL COMMODITIES

NONMETALS

Abrasive Materials.—Baraboo Quartzite Co., Inc. continued to produce deburring media from its quartzite deposit in Sauk County. The quarry is one of only two active operations in the Nation producing natural abrasives for similar use as grinding media. The other operation is located in Rock County, Minn.

Cement.—Marquette Cement Manufacturing Co., which has been manufacturing cement at its Milwaukee plant since early in February 1957, produced Types I and II (general use and moderate heat) and Type III (high-early-strength) portland cement and masonry cement. At Manitowoc, Medusa Cement Co., Div. of Medusa Corp., continued to produce portland white cement. In addition, two grinding facilities were operated in the State: Universal Atlas Cement Div. of United States Steel Corp. at Milwaukee, Milwaukee County, and Huron Cement Div. of National Gypsum Co. at Superior, Douglas County.

Portland cement shipments increased more than 26% in quantity and value over those of 1971; shipments of masonry cement increased 8% in quantity and 10% in value. Most of the cement shipments were by truck in packaged form and by rail in both bulk and packaged forms.

Consumption of portland cement in Wisconsin totaled 1,618,910 tons. It was consumed by ready-mix concrete companies (73.3%), concrete product manufacturers (16.0%), building material dealers (3.7%), and contractors and other users (7.0%). Masonry cement consumed in the State totaled 64,480 tons.

Clays.—Output of clay and shale in Wisconsin decreased for the sixth consecutive year. Companies producing were the Oakfield Shale Brick & Tile Co. in Fond du Lac County, which produced shale for its own use in making brick, and the Union Grove Drain Tile Co. in Racine County, which mined clay for its own use in manufacturing drain tile. The latter company, however, closed its mine and plant in the second half of the year.

Gem Stones.—Small quantities of semiprecious gem stones and mineral specimens continued to be collected from old mines, quarries, slag piles, and dumps.

Lime.—Wisconsin's 1972 lime output increased 7% in quantity to 263,000 tons and

Table 5.—Wisconsin: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	3,479	3,703	4,518	4,758
Fill	1,998	1,150	1,391	832
Foundry uses	--	--	38	157
Molding	673	2,058	W	W
Paving	2,766	2,719	2,241	2,184
Other uses [1]	267	726	1,213	3,188
Total [2]	9,183	10,356	9,403	11,115
Gravel:				
Building	4,067	4,442	4,822	5,300
Fill	1,238	700	1,513	1,018
Paving	11,506	10,610	7,421	6,172
Railroad ballast	W	W	121	105
Miscellaneous	W	W	456	431
Other uses	709	487	682	740
Total [2]	17,520	16,239	15,015	13,765
Government-and-contractor operations:				
Sand:				
Building	W	W	2,747	1,001
Fill	676	85	348	97
Paving	1,305	498	1,629	712
Other uses	297	106	483	179
Total [2]	2,278	690	5,206	1,989
Gravel:				
Building	W	W	1,205	632
Fill	466	71	355	59
Paving	8,826	5,234	5,240	3,761
Other uses	288	159	6	3
Total [2]	9,579	5,464	6,806	4,455
Total sand and gravel [2]	38,561	32,748	36,430	31,324

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Includes blast, railroad ballast, engine, filtration (1971), glass, oil (hydrafrac) (1971), and other sands.

[2] Data may not add to totals shown because of independent rounding.

Table 6.—Wisconsin: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Ashland	4	310	220	2	W	W
Barron	9	580	480	9	W	W
Bayfield	4	W	W	3	116	98
Brown	5	518	544	6	567	406
Buffalo	2	52	8	1	52	48
Chippewa	6	348	316	5	500	335
Clark	5	887	787	3	887	731
Columbia	4	W	W	4	913	W
Dane	27	2,028	2,508	19	1,388	1,778
Dodge	15	823	735	12	834	667
Door	4	W	W	6	450	536
Douglas	6	83	50	8	82	67
Florence	1	79	52	1	W	W
Fond du Lac	10	392	334	11	424	322
Green Lake	11	378	606	4	221	361
Jackson	4	213	264	4	168	188
Jefferson	6	W	W	5	292	201
Kenosha	6	718	508	6	237	197
Kewaunee	5	W	W	5	542	W
Lafayette	--	W	195	1	164	W
Langlade	3	495	467	2	W	W
Lincoln	6	539	468	5	489	477
Manitowoc	7	739	516	9	925	646
Marathon	10	495	398	9	395	407
Marinette	4	W	W	3	W	312
Marquette	3	W	69	6	118	W
Milwaukee	--	18	9	1	W	W
Oconto	6	886	479	7	550	489
Oneida	5	322	347	8	536	458
Outagamie	5	549	467	3	W	385
Ozaukee	9	638	571	8	544	541
Pierce	6	129	127	7	124	257
Portage	4	578	447	3	653	691
Racine	7	924	1,039	7	765	1,125
Rock	9	607	686	9	1,572	1,908
Rusk	3	W	W	3	420	331
St. Croix	2	W	W	1	233	97
Sauk	11	540	500	9	438	W
Shawano	8	347	290	7	321	286
Sheboygan	6	282	268	7	439	394
Taylor	4	304	243	3	262	257
Trempealeau	3	104	4	1	W	3
Vernon	5	81	W	2	78	46
Vilas	2	W	W	4	136	170
Walworth	18	1,145	834	15	914	680
Washburn	2	W	W	1	4	1
Washington	15	1,664	1,130	14	1,689	1,200
Waukesha	35	4,855	3,826	33	4,550	3,631
Waupaca	6	W	W	6	W	150
Winnebago	13	759	751	8	W	W
Wood	1	407	83	2	333	81
Undistributed[1]	r 49	13,746	11,126	50	12,106	10,416
Total[2]	401	38,561	32,748	368	36,430	31,324

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Adams, Burnett, Calumet, Crawford, Dunn, Eau Claire, Forest, Grant, Green, Iron, Juneau, La Crosse, Monroe, Pepin, Polk, Price, Richland, Sawyer and Waushara Counties, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

was 6% above that of the 1970 record. Companies producing were the Cutler-La-Liberte-McDougall Corp. in Douglas County, the Western Lime & Cement Co. with plants in Brown, Dodge, and Fond du Lac Counties, Mayville White Lime Works in Dodge County, and the Rockwell Lime Co. in Manitowoc County. The lime was used for paper and pulp, mason's lime, water purification, sewage treatment and other uses. It was consumed in Wisconsin, Minnesota, Illinois, other States, and Canada. Total consumption of lime in Wisconsin was 152,399 tons.

Perlite.—Expanded perlite was produced at Milwaukee and Appleton from crude material mined outside the State. Material was used for plaster aggregate, concrete aggregate, horticultural aggregates, masonry and cavity fill insulation, granules, etc. Sales decreased in quantity but increased in value as compared with those of 1971.

Sand and Gravel.—Wisconsin contributed 4% of the total sand and gravel production in the United States and ranked sixth in quantity and fourteenth in value of sand and gravel produced. Among all mineral commodities produced in Wisconsin, sand and gravel ranked first, representing 35.1% of the State's total mineral output value. Production, which decreased 5.5% in quantity and 4.3% in value from the 1971 figures, was reported from 70 of the 72 counties. Counties with production of more than 1 million tons of sand and gravel, in descending order of quantity, were Waukesha, Washington, Rock, and Dane.

Stone.—Stone production in Wisconsin, consisting of basalt, granite, limestone and dolomite, sandstone, and quartzite, was 19.4 million tons valued at $29.7 million, an increase of 24.6% in quantity and 18.2% in value over that of 1971. Among all mineral commodities produced in Wisconsin, stone ranked second in value, representing 33.2% of the State's mineral output value.

Production of crushed and broken stone comprised 99.6% in quantity and 88.3% in value of all stone produced in the State. Of the crushed and broken stone, 81.8% of the tonnage was crushed and broken limestone and dolomite.

Fifty of the State's 72 counties reported stone production. Counties that produced more than one million tons, in descending order of quantity, were Waukesha, Marathon, Dane, and Racine.

Vermiculite.—Exfoliated vermiculite was produced by Construction Products Div. of W. R. Grace & Co. at Milwaukee and by Koos, Inc. at Kenosha from crude material mined outside the State. The exfoliated material was used for loose fill insulation, fertilizer, horticulture, concrete aggregate, plaster aggregate, and other purposes.

Table 7.—Wisconsin: Limestone and dolomite sold or used by producers, by use

(Thousand short tons and thousand dollars unless otherwise specified)

Use	1971		1972	
	Quantity	Value	Quantity	Value
Dimension:				
Rough architectural [1] thousand cubic feet	23	22	46	39
Irregular-shaped stone	9	139	11	178
Rubble	22	204	18	168
Cut stone thousand cubic feet	25	95	31	67
House stone veneer do	181	499	176	467
Sawed stone do	23	62	24	83
Construction do	135	178	94	127
Flagging do	127	151	107	129
Total thousand short tons	72	1,350	68	[2] 1,260
Crushed and broken:				
Bituminous aggregate	748	1,007	1,044	1,268
Concrete aggregate	794	1,238	865	1,264
Dense graded road base stone	5,146	6,466	6,372	7,616
Macadam aggregate	1,282	1,831	945	1,300
Surface treatment aggregate	1,594	1,956	2,612	3,399
Unspecified aggregate and roadstone	3,068	3,990	2,614	3,872
Agricultural limestone	616	1,336	670	1,349
Filter stone	W	W	17	39
Riprap and jetty stone	W	W	211	337
Other [3]	397	1,041	449	749
Total [2]	13,644	18,866	15,799	21,194
Grand total	13,716	20,216	15,867	22,454

W Withheld to avoid disclosing individual company confidential data; included with "Other."

[1] Includes monumental and other rough stone.

[2] Data may not add to totals shown because of independent rounding.

[3] Includes stone used in lime manufacture, railroad ballast, flux, acid neutralization, fill and unspecified uses; 1972 data also include stone used in drain fields, disinfectant and animal sanitation, and stone sand.

Table 8.—Wisconsin: Stone sold or used by producers, by county
(Thousand short tons and thousand dollars)

County	1971			1972			Kind of stone produced in 1972[1]
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Brown	7	573	768	10	670	970	Limestone.
Buffalo	12	W	W	8	W	W	Do.
Burnett	--	--	--	1	W	W	Other stone.
Calumet	3	W	W	3	W	155	Limestone.
Clark	1	W	W	1	W	W	Granite.
Columbia	4	W	W	4	W	W	Limestone.
Crawford	13	210	229	9	252	252	Do.
Dane	21	476	557	23	1,255	2,036	Do.
Dodge	5	338	557	8	585	728	Do.
Door	2	W	W	4	W	W	Do.
Douglas	2	W	W	1	3	W	Traprock.
Dunn	3	W	W	3	43	58	Limestone.
Fond du Lac	13	276	976	18	347	912	Do.
Grant	24	791	939	18	714	927	Do.
Green	25	489	669	24	515	521	Do.
Green Lake	4	W	W	3	25	36	Limestone, other stone.
Iowa	20	373	332	19	443	418	Limestone.
Jackson	--	--	--	1	W	W	Do.
Jefferson	1	W	W	1	W	W	Do.
Juneau	2	W	W	2	W	W	Do.
Kewaunee	1	W	W	1	W	W	Do.
La Crosse	5	W	W	2	W	W	Do.
Lafayette	17	461	545	20	573	509	Do.
Manitowoc	2	267	694	3	W	550	Do.
Marathon	20	1,030	2,668	16	1,767	3,560	Granite, quartzite, sandstone.
Marinette	1	W	W	1	W	W	Traprock.
Marquette	3	W	W	2	W	W	Granite, limestone.
Milwaukee	4	W	W	2	W	W	Limestone.
Monroe	9	197	257	8	W	W	Do.
Oconto	3	W	W	3	W	W	Do.
Oneida	2	W	W	--	--	--	
Outagamie	5	W	W	3	W	W	Do.
Ozaukee	2	W	W	2	W	W	Do.
Pepin	1	W	W	6	146	169	Do.
Pierce	3	W	W	12	W	W	Do.
Polk	1	28	39	2	W	W	Limestone, traprock.
Racine	6	W	W	6	1,220	W	Limestone.
Richland	18	W	W	3	W	W	Do.
Rock	15	290	419	14	489	636	Limestone, sandstone.
St. Croix	10	240	277	7	W	W	Limestone.
Sauk	18	W	919	9	709	923	Limestone, quartzite, sandstone.
Shawano	3	W	W	2	W	87	Limestone.
Sheboygan	1	W	W	1	4	25	Do.
Trempealeau	9	W	W	5	W	W	Do.
Vernon	34	W	W	12	W	W	Do.
Walworth	1	20	W	1	24	W	Do.
Washington	--	--	--	1	34	33	Sandstone.
Waukesha	27	W	3,489	23	2,270	3,419	Limestone.
Waupaca	3	33	54	2	21	36	Do.
Waushara	1	W	W	--	--	--	
Winnebago	14	1,045	1,730	15	W	W	Limestone.
Wood	3	68	104	2	79	117	Granite, sandstone.
Various	3	W	W	1	W	W	Limestone.
Undistributed	--	8,362	8,885	--	7,257	12,605	
Total[2]	r 407	15,568	25,105	343	19,394	29,681	

r Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] "Limestone" used generally to include dolomite.

[2] Data may not add to totals shown because of independent rounding.

METALS

Copper.—Kennecott Copper Corp., which owns about 250 acres of land in Rusk County and has additional acreage under option, is considering open pit mining of the Flambeau deposit, near Ladysmith, within the next few years. All elements of the possible mining operation are being studied.

The deposit, discovered late in 1968, reportedly[2] is a nearly vertical tabular-shaped vein composed almost entirely of sulfide minerals. It averages about 50 feet in width, is approximately 2,400 feet long, and extends to an average depth of 800 feet below surface. It does not outcrop at the surface. Most of the vein material is pyrite and the copper sulfide ore occurs scattered throughout the vein-forming pyrite.

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[2] Engineering and Mining Journal. V. 174, No. 3, March 1973, p. 19.

Iron Ore.—Output of taconite pellets produced by the Jackson County Iron Co., a wholly owned subsidiary of Inland Steel Co., increased from 824,000 long tons in 1971 to 887,000 long tons in 1972. Pellets were shipped by rail to Inland's Indiana Harbor Works in East Chicago, Ind.

Lead and Zinc.—Output of 757 short tons of lead and 6,873 short tons of zinc (in terms of recoverable metals), compared with 752 short tons of lead and 10,645 short tons of zinc in 1971, represented a slight increase in lead production but a decrease of 35% in zinc production. In terms of total value, lead production increased 10%, but zinc production declined nearly 29%. Average yearly weighted prices, used in calculating 1972 values in table 1, were 15.03 cents per pound for lead and 17.75 cents per pound for zinc, compared with 1971 average prices of 13.8 cents per pound for lead and 16.1 cents per pound for zinc.

MINERAL FUELS

Coke.—Coke continued to be produced by Milwaukee Solvay Coke Co., a division of Pickands Mather & Co., the only coke producer in Wisconsin. Foundries are the principal consumers of coke in the State.

Peat.—Although peat is classed as a mineral fuel, its principal use in the United States is for agricultural purposes. Sales of peat in Wisconsin in 1972 totaled 1,815 short tons, an increase of 15.2% over the 1971 figure of 1,575 short tons; 97.8% of the peat sold was used for seed inoculant, and the remainder was used for general soil improvement. Most of the peat was sold in packaged form.

Only one company, Demilco, Inc., was active in Wisconsin during the year. It produced humus peat from a bog near Wales in Waukesha County.

Petroleum and Natural Gas Exploration.—During 1972, some test drilling was conducted by the Mission Hills Oil Corp. of Green Bay, Wis., in search of oil or gas in Calumet, Kewaunee, Door, and Fond du Lac Counties.

Petroleum Refineries.—Murphy Oil Corp.'s Superior refinery was the only petroleum refinery in operation in Wisconsin in 1972. This refinery, which went onstream in 1951 with a capacity of 3,800 barrels per day, was acquired by Murphy Oil Corp. in 1958. It has been continually expanded and modernized; the refinery now has a capacity of 35,500 barrels per day. Throughput in 1972 averaged 31,600 barrels per day. Refinery output consisted of gasoline, home heating oils, residual fuel oil, liquefied petroleum gas, and asphalt. Production of elemental sulfur is expected to begin in 1973.

Table 9.—Wisconsin: Mine production (recoverable) of lead and zinc

		1970	1971	1972
Mines producing: Lode		8	3	1
Material sold or treated: Zinc ore	thousand short tons	749	414	293
Production (recoverable):				
Lead	short tons	761	752	757
Zinc	do	20,634	10,645	6,873
Value:				
Lead	thousands	$238	$207	$228
Zinc	do	6,322	3,428	2,440
Total	do	[1] 6,559	3,635	2,668

[1] Data do not add to total shown because of independent rounding.

Table 10.—Principal producers

Commodity	Address	Type of activity	County
Abrasive stone:			
Baraboo Quartzite Co., Inc	Box 123 Baraboo, Wis. 53913	Quarry; stationary plant.	Sauk.
Cement:			
Marquette Cement Mfg. Co	20 N. Wacker Dr. Chicago, Ill. 60606	Portland and masonry, dry process.	Milwaukee.
Medusa Cement Co., Div. of Medusa Corp.	Box 5668 Cleveland, Ohio 44101	White, dry process	Manitowoc.
Clays and shale:			
Oakfield Shale Brick & Tile Co	Oakfield, Wis. 53065	Pit and plant	Fond du Lac.
Union Grove Drain Tile Co	Box 348 Union Grove, Wis. 53182	do	Racine.
Coke:			
Milwaukee Solvay Coke Div., Pickands Mather & Co.	311 E. Greenfield Ave. Milwaukee, Wis. 53204	Coke ovens	Milwaukee.
Iron ore:			
Jackson County Iron Co Inland Steel Co.: Black River Falls.	30 W. Monroe St. Chicago, Ill. 60603	Mine, concentrator, agglomerator.	Jackson.
Lead and zinc:			
Eagle-Picher Industries, Inc.:			
Shullsburg	Box 406 Galena, Ill. 61036	Mine and mill	Lafayette.
Lime:			
Cutler-LaLiberte-McDougall Corp.	12th Ave. & Waterfront Duluth, Minn. 55802	Quick and hydrated, two rotary kilns, one continuous hydrator.	Douglas.
Mayville White Lime Works	Box 25 Mayville, Wis. 53050	Quicklime, one shaft kiln.	Dodge.
Rockwell Lime Co	Route 4 Manitowoc, Wis. 54220	Quick and hydrated, one rotary kiln, one continuous hydrator.	Manitowoc.
The Western Lime & Cement Co.:			
Green Bay plant	Box 2076 Milwaukee, Wis. 53201	Quick and hydrated, five shaft kilns, one batch hydrator.	Brown.
Knowles plant		Hydrated, five shaft kilns, one continuous hydrator.	Dodge.
Eden plant		Quick and hydrated, five shaft kilns, one batch hydrator.	Fond du Lac.
Peat:			
Demilco, Inc	3101 W. Custer Ave. Milwaukee, Wis. 53209	Bog, processing plant.	Waukesha.
Expanded perlite:			
Midwest Perlite Co	912 College Ave. Appleton, Wis. 54911	Processing plant	Outagamie.
Zonolite Division, W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	do	Milwaukee.
Petroleum refinery:			
Murphy Oil Corp	200 Jefferson Ave. El Dorado, Ark. 71730	Refinery	Douglas.
Sand and gravel:			
American Materials Corp	104 Gibson St. Eau Claire, Wis. 54756	Pit; dredge, portable, and stationary plants.	Dunn, Eau Claire.
Janesville Sand & Gravel Co	1110 Harding St. Janesville, Wis. 53545	Pit; stationary plant.	Rock.
J. William Kennedy & Son	P.O. Box 813 Janesville, Wis. 53545	Pits; portable plants.	Green, Rock, Walworth.

Table 10.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Sand and gravel—Continued			
Edward Kraemer & Sons, Inc	Plain, Wis. 53577	Pits; portable plants.	Barron, Bayfield, Brown, Chippewa, Dane, Douglas, Eau Claire, Jackson, Kenosha, Lincoln, Oconto, Oneida, Ozaukee, Polk, Racine, Sauk, Sawyer, Sheboygan, Walworth, Washington, Waukesha, Waushara.
C. C. Linck, Inc	1226 N. Center St. Beaver Dam, Wis. 53916	do	Dodge, Fond du Lac, Marquette, Oneida, Sheboygan.
Manley Sand Division, Martin Marietta Corp.	Rockton, Ill. 61072	Pit; stationary plant; industrial sand.	Columbia.
Plautz Brothers, Inc	Route 1 Willard, Wis. 54493	Pit; stationary plant.	Clark.
Arthur Overgaard Inc	Box 87 Elroy, Wis. 53929	Pits; portable and stationary plants.	Various.
Schuster Constr. Co	300 Elizabeth St. Green Bay, Wis. 54302	Pits; stationary plants.	Brown, Kewaunee.
Stone:			
Granite:			
Anderson Bros. & Johnson Co.	Box 26 E. Manson St. Wausau, Wis. 54401	Quarries; stationary plant.	Marathon.
Lawrence Ladick, Inc	Route 1 Vesper, Wis. 54489	Quarry	Do.
Lake Wausau Granite Co	Box 397 Wausau, Wis. 54401	Quarry; stationary plant.	Do.
Limestone and dolomite:			
Courtney & Plummer, Inc	Box 351 Neenah, Wis. 54956	Quarries; stationary and portable plants.	Calumet, Winnebago.
Daanen & Janssen	124 S. Huron St. De Pere, Wis. 54115	Quarries; portable plants.	Brown.
Franklin Stone Products, Inc.	7220 S. 68th St. Hales Corners, Wis. 53130	Quarry; stationary plant.	Milwaukee.
Halquist Lannon Stone Co	Sussex, Wis. 53089	Quarries; stationary plant.	Waukesha.
Edward Kraemer & Sons, Inc.	Plain, Wis. 53577	Quarries; portable plants.	Buffalo, Columbia, Crawford, Dane, Dunn, Green, Juneau, La Crosse, Marquette, Monroe, Pepin, Pierce, Richland, Sauk, Trempealeau, Vernon.
Arthur Overgaard, Inc	Box 87 Elroy, Wis. 53929	Quarries; stationary and portable plants.	Juneau, Various counties.
Vulcan Materials Co., Midwest Division.	P.O. Box 6 Countryside, Ill. 60525	Quarries; stationary plants.	Milwaukee, Racine, Waukesha.

Table 10.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Stone—Continued			
Limestone and dolomite—Continued			
Waukesha Lime & Stone Co.	Box 708 Waukesha, Wis. 53186	Quarry; stationary and portable plants.	Waukesha.
Wingra Stone Co., Inc., Stewart Watson Construction Co.	Route 2, Box 4284 Madison, Wis. 53711	Portable plants	Dane.
Quartzite:			
Foley Bros., Inc.	450 Endicott Bldg. on 4th St. Paul, Minn. 55101	Quarry; stationary plant.	Sauk.
Minnesota Mining & Mfg. Co.	2501 Hudson Rd. St. Paul, Minn. 55119	Quarries; stationary plant.	Marathon.
Sandstone:			
Ellis Quarries, Inc.	Stevens Point, Wis. 55481	do	Marathon, Wood.
Traprock (basalt):			
Bryan Rock Products Inc.	Box 215 Shakopee, Minn. 55379	Quarry; stationary and portable plants.	Polk.
GAF Corp.	Pembine, Wis. 54156	Quarry; stationary plant.	Marinette.
McLean Construction Co.	314 Ogden Ave. Superior, Wis. 54880	Quarry; portable plant.	Douglas.
Vermiculite, exfoliated:			
Koos, Inc.	4500 13th Court Kenosha, Wis. 53140	Processing plant	Kenosha.
Construction Products Div., W. R. Grace & Co.	62 Whittemore Ave. Cambridge, Mass. 02140	do	Milwaukee.

The Mineral Industry of Wyoming

This chapter has been prepared under a cooperative agreement between the Bureau of Mines, U.S. Department of the Interior, and the Geological Survey of Wyoming for collecting information on all minrals.

By Eugene R. Slatick[1]

In 1972, as in previous years, Wyoming's mineral industry maintained its place as a major sector of the State's economy. The total value of mineral production reached $747 million, compared with $718 million in 1971. The per capita value of mineral production in 1972 was approximately $2,200. The principal minerals according to value were crude oil, sodium carbonate, natural gas, uranium, and coal. Together they were valued at more than $650 million. Mineral fuels, including natural gas liquids and uranium, were valued at about $612 million, more than 82% of the total value.

Wyoming's crude oil production ranked fifth in the Nation and first in the Rocky Mountain Region, but the total output declined during the year. The quantity of natural gas marketed declined, but the value rose. Natural gas liquids increased in both quantity and value.

Coal production reached an alltime record, ranking Wyoming 10th among the Nation's coal producers. Two new coal companies began operations. Additional expansions underway during the year are expected to result in a continued rise in coal production. Wyoming's coal, which is low in sulfur, was used mainly to generate electric power. About 45% of the coal produced during the year was used by powerplants in the State.

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[1] Mineral specialist, Division of Fossil Fuels—Mineral Supply.

Table 1.—Mineral production in Wyoming[1]

Mineral	1971		1972	
	Quantity	Value (thousands)	Quantity	Value (thousands)
Clays ... thousand short tons	1,798	$17,378	1,873	$18,509
Coal (bituminous) ... do	8,052	27,335	10,928	40,898
Gem stones	NA	135	NA	142
Gypsum ... thousand short tons	[r] 232	918	W	W
Iron ore (usable) ... thousand long tons, gross weight	1,808	W	2,030	W
Lime ... thousand short tons	27	W	W	W
Natural gas ... million cubic feet	380,105	58,156	375,059	60,760
Natural gas liquids:				
LP gases ... thousand 42-gallon barrels	5,474	10,127	7,691	15,536
Natural gasoline and cycle products ... do	2,514	7,415	3,015	8,951
Petroleum (crude) ... do	148,114	459,079	140,011	432,071
Sand and gravel ... thousand short tons	9,820	8,750	9,098	14,916
Stone ... do	2,894	4,789	3,549	5,768
Uranium ... thousand pounds	6,986	[2] 43,311	8,544	[2] 53,827
Value of items that cannot be disclosed:				
Cement, feldspar, phosphate rock, pumice (1972), sodium carbonate and values indicated by symbol W	XX	80,544	XX	95,365
Total	XX	717,937	XX	746,743
Total 1967 constant dollars	XX	610,462	XX	[p] 621,216

[p] Preliminary. [r] Revised. NA Not available. W Withheld to avoid disclosing individual company confidential data; included with "Value of items that cannot be disclosed." XX Not applicable.

[1] Production as measured by mine shipments, sales, or marketable production (including consumption by producers).

[2] Bureau of Mines estimate.

Uranium production increased in both quantity and value. Wyoming's production and reserves continued to rank second in the Nation.

Wyoming's production and reserves of sodium carbonate ranked first in both the Nation and the world. The sodium carbonate industry, the most important nonmetallic industry in the State, continued to expand its production capacity.

During the year the mining industry continued to reclaim surface-mined land and areas covered by mineral-related wastes. According to estimates compiled under Wyoming's Open Cut Land Reclamation Act of 1969, surface mining affected 2,737 acres in 1971, the most recent year for which information was available. During the same year, 1,875 acres were reclaimed. The coal sector accounted for about 37% of the acreage surface mined and about 39% of the reclamation.

The land covered by mineral-related wastes through 1971 totaled an estimated 17,941 acres, of which coal mining wastes comprised about 3,936 acres. Comparable totals for earlier years are 15,203 acres (coal mining, 2,920 acres) in 1970 and 9,985 acres (coal mining, 2,209 acres) in 1969. The reclaimed mineral-waste areas totaled an estimated 4,885 acres through 1971, including 1,143 acres reclaimed by the coal sector. In 1970 the reclaimed mineral-waste land was 2,515 acres (coal mining, 415 acres), compared with 1,799 acres (coal mining, 305 acres) in 1969.

According to a summary of the fuel and energy consumed by the individual States in 1971, Wyoming's consumption that year consisted of 3.7 million tons of coal, 16.1

Table 2.—Value of mineral production in Wyoming, by county

(Thousands)

County	1971	1972	Minerals produced in 1972 in order of value
Albany	$6,877	$6,722	Cement, petroleum, stone, sand and gravel, iron ore, gypsum.
Big Horn	27,790	26,462	Petroleum, clays, gypsum, natural gas, sand and gravel, lime, stone.
Campbell	128,441	131,300	Petroleum, natural gas, natural gas liquids, coal, pumice, sand and gravel.
Carbon	35,601	52,584	Uranium, coal, petroleum, natural gas, natural gas liquids, sand and gravel, stone.
Converse	22,293	26,498	Petroleum, coal, natural gas liquids, uranium, sand and gravel, natural gas.
Crook	21,693	19,642	Petroleum, clays, stone, natural gas, sand and gravel.
Fremont	83,175	88,360	Petroleum, uranium, iron ore, natural gas, natural gas liquids, sand and gravel, feldspar, stone.
Goshen	458	381	Lime, sand and gravel, petroleum.
Hot Springs	33,811	28,729	Petroleum, natural gas liquids, natural gas, coal, sand and gravel.
Johnson	16,870	15,518	Petroleum, clays, natural gas liquids, sand and gravel.
Laramie	2,739	3,661	Stone, uranium, sand and gravel.
Lincoln	14,135	16,130	Coal, natural gas liquids, phosphate rock, natural gas, petroleum, sand and gravel.
Natrona	51,014	53,294	Petroleum, uranium, natural gas, natural gas liquids, clays, sand and gravel, stone.
Niobrara	1,916	2,434	Petroleum, sand and gravel, natural gas.
Park	109,934	94,030	Petroleum, natural gas, natural gas liquids, gypsum, stone, sand and gravel.
Platte	4,727	5,014	Iron ore, stone, sand and gravel.
Sheridan	8,026	4,671	Coal, petroleum, sand and gravel, stone.
Sublette	24,581	25,217	Petroleum, natural gas, sand and gravel, natural gas liquids.
Sweetwater	97,076	109,718	Sodium carbonate, petroleum, natural gas, coal, natural gas liquids, sand and gravel.
Teton	209	W	Stone, sand and gravel.
Uinta	1,674	1,425	Natural gas, natural gas liquids, clays, sand and gravel, stone.
Washakie	11,020	10,850	Petroleum, natural gas, natural gas liquids, lime, sand and gravel.
Weston	12,452	13,806	Petroleum, clays, sand and gravel, natural gas.
Undistributed [1]	1,424	10,306	
Total [2]	717,937	746,743	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes value of mineral production that cannot be assigned to specific counties and values indicated by symbol W.

[2] Data may not add to totals shown because of independent rounding.

million barrels of petroleum products, 115.3 billion cubic feet of natural gas, and 1.3 billion kilowatt-hours of electricity.[2] The major consuming sectors for the fuels and the comparable energy values were as follows: Coal—electric power generation, 3.5 million tons (80 trillion Btu); petroleum products—transportation, 10 million barrels (54.6 trillion Btu); household and commercial, 3.5 million barrels (18.7 trillion Btu); industrial, 2.4 million barrels (14 trillion Btu); natural gas—industrial, 72 billion cubic feet (74.2 trillion Btu); household and commercial, 32.4 billion cubic feet (33.4 trillion Btu). The gross energy consumption totaled 305.4 trillion Btu. The net energy consumption totaled 220.9 trillion Btu, which was equivalent to 650 million Btu per capita.

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[2] U.S. Dept. of the Interior. United States Energy Fact Sheets by States and Regions—1971. February 1973, pp. 104–105.

Table 3.—Indicators of Wyoming business activity

	1971	1972 p	Change, percent
Employment and labor force, annual average:			
Total labor force .... thousands..	145.4	150.4	+3.4
Employment .... do....	139.0	144.3	+3.8
Unemployment .... do....	6.4	6.1	−4.7
Nonagricultural employment:			
Mining .... do....	10.9	11.8	+8.3
Contract construction .... do....	7.9	9.8	+24.0
Manufacturing .... do....	7.4	7.6	+2.7
Government .... do....	28.9	32.1	+11.1
Services .... do....	17.0	17.7	+4.1
Wholesale and retail trade .... do....	24.9	25.0	+0.4
Transportation and public utilities .... do....	10.6	11.1	+4.7
Finance, insurance, and real estate .... do....	3.6	3.7	+2.8
Personal income:			
Total .... millions..	$1,331	$1,499	+12.6
Per capita	$3,929	$4,345	+10.6
Construction activity:			
Number of new residential units authorized	1,365	1,704	+24.8
Value of authorized nonresidential construction .... millions..	$8.2	$13.5	+64.6
Highway construction contracts awarded .... do....	$48.4	• $46.0	−5.0
Cement shipments to and within Wyoming ..... thousand short tons..	169	196	+16.0
Farm marketing receipts .... millions..	$275.0	$365.9	+33.0
Mineral production value .... do....	$717.9	$746.7	+4.0

• Estimated. p Preliminary.

Sources: Survey of Current Business; Employment and Earnings; Farm Income Situation; Construction Review; Area Trends in Employment and Unemployment; Roads and Streets; and U.S. Bureau of Mines.

Table 4.—Worktime and injury experience in the mineral industries

Year and industry	Average men working daily	Days active	Man-days worked (thousands)	Man-hours worked (thousands)	Number of injuries		Injury rates per million man-hours	
					Fatal	Nonfatal	Frequency	Severity
1971:								
Coal	818	185	151	1,173	1	28	24.72	NA
Metal	1,985	284	564	5,065	3	112	22.71	4,168
Nonmetal	1,535	293	450	3,670	--	36	9.81	116
Sand and gravel	662	179	118	977	--	27	27.64	1,099
Stone	273	209	57	474	--	12	25.33	445
Total	5,273	254	[1] 1,341	11,359	4	215	19.28	NA
1972: [2]								
Coal	NA	NA	NA	NA	NA	NA	NA	NA
Metal	1,915	290	555	4,939	--	97	19.64	399
Nonmetal	1,745	297	519	4,193	1	40	9.78	2,001
Sand and gravel	300	146	44	389	1	6	17.98	15,867
Stone	230	244	56	472	--	13	27.55	269
Total	NA	NA	NA	NA	NA	NA	NA	NA

NA Not available.

[1] Data do not add to total shown because of independent rounding.

[2] In 1971 and earlier years, estimates were made of injury and employment data for those active operators who did not file reports; however, no estimates were made for active operators who did not report in 1972. Tabulations were made from data in file as of July 1, 1973 and are preliminary.

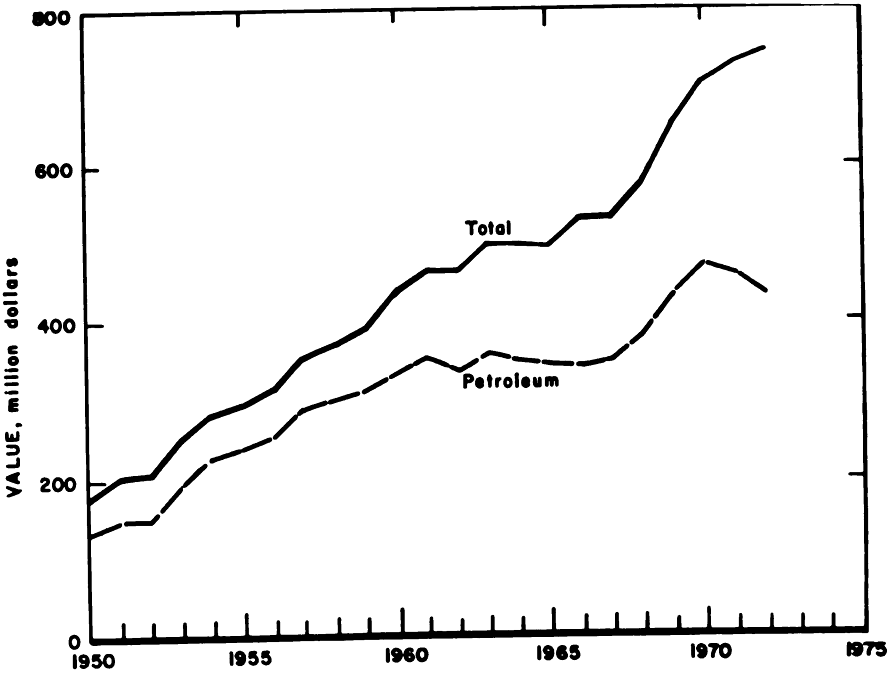

Figure 1.—Value of petroleum and total value of mineral production in Wyoming.

Legislation and Government Programs.—Bills scheduled for consideration by the State legislature in 1973 include a mined land reclamation bill designed to amend the State's Open Cut Land Reclamation Act of 1969 to include land reclamation for underground mining that causes surface subsidence. The bill would require a permit for surface and underground mining, the submission of a plan for reclamation before the issuance of a permit, and a bond to insure reclamation. Another bill will propose the creation of a State mine health research commission to conduct studies pertaining to health and safety, particularly in the trona and uranium mines. A bill will also be proposed that will give the State enforcement and regulatory powers governing uranium operations. A model law for the control of radioactive wastes was sent to Wyoming State agencies by the Environmental Protection Agency (EPA). In 1973 the legislature will also be requested to expand the State's air quality program. In 1972 the Governor recommended the creation of a State Environ-

Table 5.—Wyoming: Estimated acreage of surface mined and reclaimed land

Commodity	1969		1970		1971	
	Surface mined	Reclaimed	Surface mined	Reclaimed	Surface mined	Reclaimed
Clay	29	--	579	419	434	305
Coal	154	51	558	59	1,016	728
Gypsum	12	--	1	--	4	--
Iron ore	83	60	119	43	120	97
Phosphate	100	--	--	--	30	8
Sand and gravel	14	3	51	73	133	45
Stone	49	--	7	2	16	--
Other and unknown	2,278	424	1,186	77	984	692
Total	2,719	538	2,501	673	2,737	1,875

Source: Wyoming Commissioner of Public Lands.

mental Protection Agency. The Wyoming Geological Survey published a compilation of the State's mining laws.[3]

Because Wyoming's air quality implementation plan was among those disapproved by EPA, and because the State lacks the legal authority to adopt and enforce such plans, EPA will carry out the programs in the State for the approval and promulgation of air quality implementation plans.[4] Accordingly, EPA will review new sources and proposed modifications of existing stationary sources of air pollution. It will also make emission data available to the public and can require operators to keep records and install monitoring devices. The Federal regulations began in October and will remain in effect until the Wyoming legislature grants the State authority over such matters. Wyoming's air quality program was reviewed in a report released during the year.[5]

EPA completed a detailed survey of radiation levels of uranium mill tailings in the Riverton area and found no apparent harmful radioactive sources.

The Wyoming Water Development Program, a division of the State Engineer's Office, released a report on the water supply that will be needed to meet the State's projected industrial growth. Reportedly, if coal industry developments in the Powder River Basin continued as projected, the region's water resources would be exceeded within 28 years.

Late in the year the Secretary of the Interior created a Federal-State task force to assess the social, economic, and environmental impacts that could result from the development of coal and other resources in Wyoming, Montana, North Dakota, South Dakota, and Nebraska. The project was designated the "Northern Great Plains Resource Program."

The U.S. Department of Housing and Urban Development awarded $400,000 to a neighborhood development program in Rock Springs for work in areas damaged by mine subsidence.[6] An additional $2.3 million in credit was also provided. The Federal Bureau of Mines was cooperating with the Rock Springs Urban Renewal Agency in determining the areas in which no further subsidence is expected and those that will require additional work.

The mineral resource potential of the Cloud Peak Primitive Area in north-central Wyoming was investigated jointly by the U.S. Geological Survey and the Federal Bureau of Mines.[7] The area has been prospected, but no mineral production has been reported. It has no potential for coal, petroleum, or for appreciable quantities of other minerals. The Cloud Peak Primitive Area includes parts of Big Horn, Johnson, and Sheridan Counties.

A study of the metal distribution in the Stinkingwater mining region, Park County, revealed the presence of a central zone of copper-molybdenum minerals surrounded by a fringe area of veins containing minerals of silver, gold, lead, zinc, arsenic, and possibly mercury.[8]

Several pertinent publications and maps were released during the year.[9] Reports pertaining to specific minerals are listed in the various reviews by mineral commodities.

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[3] Wyoming Geological Survey. Mineral and Mining Laws of Wyoming. 1973, 298 pp.

[4] Approval and Promulgation of Implementation Plans. National Ambient Air Quality Standards. Federal Register, V. 37, No. 185, Sept. 22, 1972, pp. 19806–19815.

[5] Ward, C. Wyoming's Air Quality Program: A Report to the Public. Wyo. Dept. Health and Social Services, Cheyenne, Wyo., 1972, 59 pp.

[6] Riverton Ranger. V. 66, No. 76, June 15, 1972, p. 11-B.

[7] Kiilsgaard, T. H., G. E. Ericksen, L. L. Patten, and C. L. Bieniewski. Mineral Resources of the Cloud Peak Primitive Area, Wyo. U.S. Geol. Survey Bull. 1371–C, 1972, pp. C1–C60.

[8] Fisher, F. S. Tertiary Mineralization and Hydrothermal Alteration in the Stinkingwater Mining Region, Park County, Wyo. U.S. Geol. Survey Bull. 1332–C, 1972, pp. C1–C33.

[9] American Association of Petroleum Geologists, Geological Highway Map, Northern Rocky Mountain Region: Idaho, Montana, Wyoming, 1972.

Crist, M. A., and M. E. Lowry. Ground-Water Resources of Natrona County, Wyo. U.S. Geol. Survey Water-Supply Paper 1897, 1972, 92 pp.

Goodier, J. T., and M. E. Loomis. 1972 Wyoming Mineral Yearbook. State Dept. of Econ. Planning and Development, 1973, 61 pp.

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REVIEW BY MINERAL COMMODITIES

MINERAL FUELS

Coal (Bituminous).—Wyoming's coal production in 1972 reached a record 10.9 million tons, compared with 8.1 million tons in 1971. The value increased to $40.9 million from $27.3 million the previous year. The production ranked Wyoming 10th in the Nation, up from 11th in 1971. In the national ranking, Wyoming was preceded by Tennessee and followed by New Mexico, which ranked 10th in 1971. Wyoming's previous record coal production was 9.8 million tons in 1945, after which the output declined to 1.6 million tons in 1958 before recovering and rising gradually to the 1972 record. As in recent years, most of Wyoming's production in 1972 was from strip mining. It accounted for about 10.5 million tons, about 96% of the total, as compared with 7.9 million tons, a 98% share, in 1971. Approximately 34.5 million cubic yards of overburden was excavated; it ranged from about 20 to 85 feet in thickness in most counties. A total of 17 power shovels and 10 draglines operated during the year.

A sharp rise in the output from Carbon County contributed significantly to the record 1972 production. The county accounted for about 4.2 million tons, more than double its total in 1971. By contrast, Carbon County produced 615,000 tons in 1969 and 477,000 tons in 1968. Converse and Lincoln Counties also reported large increases in production in 1972.

During the year about 5.2 million tons of coal, approximately 48% of the State's production, was shipped to consumers in Wyoming. Electric powerplants accounted for about 4.9 million tons, or 94%, of the total. By comparison, in 1971 the powerplants received about 3.5 million tons of the 3.7 million tons delivered in Wyoming that year. In 1972 Wyoming's coal was also shipped to powerplants as far east as Indiana and Illinois and as far west as Washington and Oregon. Coal shipments by unit train totaled about 2.9 million tons.

Fifteen companies mined coal from 20 operations during 1972. According to the State Inspector of Mines, they ranged in size from the one-man operation of the Best Coal Co. to almost 200 men at the Sorensen mine of Kemmerer Coal Co.

The major companies, as reported by the State Inspector of Mines, were Pacific Power & Light Co., which produced 2.6 million tons from the Dave Johnston mine in Converse County; Arch Minerals Corp., which had a total of almost 2.2 million tons from the Seminoe No. 1 and No. 2 mines in Carbon County; Kemmerer Coal Co., which reported 2.1 million tons from its Sorensen and Elkol mines in Lincoln County; and Rosebud Coal Sales Co., which extracted 1.1 million tons from the Rosebud 4A mine in Carbon County. Together these companies, all strip mine operations, accounted for about 73% of the

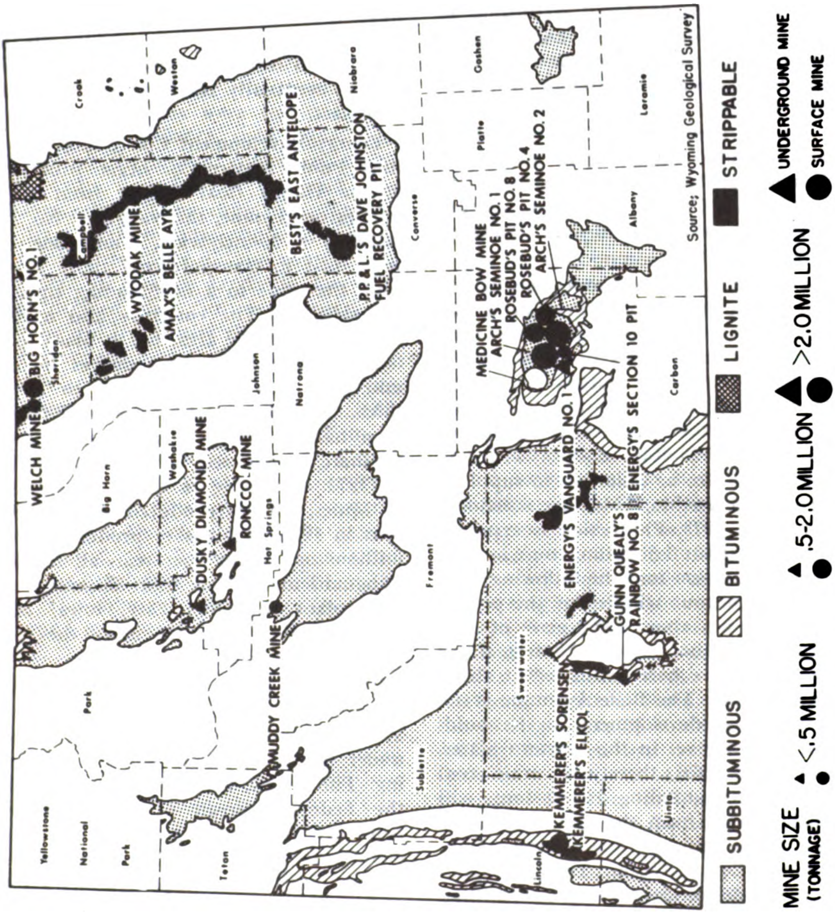
Table 6.—Wyoming: Bituminous coal production in 1972, by type of mine and county

(Excludes mines producing less than 1,000 short tons annually)

County	Number of Mines			Production (thousand short tons)			Value (thousands)
	Underground	Strip	Total	Underground	Strip	Total[1]	
Campbell	--	2	2	--	656	656	W
Carbon	1	4	5	335	3,843	4,178	$16,274
Converse	--	2	2	--	2,622	2,622	W
Hot Springs	2	--	2	6	--	6	W
Lincoln	--	2	2	--	2,103	2,103	W
Sheridan	--	2	2	--	974	974	W
Sweetwater	2	1	3	101	289	389	1,944
Undistributed	--	--	--	--	--	--	22,680
Total	5	13	18	442	10,487	10,928	40,898

W Withheld to avoid disclosing individual company data; included with "Undistributed."

[1] Data may not add to totals shown because of independent rounding.



Source; Wyoming Geological Survey

Figure 2.—Coal-bearing regions of Wyoming.

year's production. The new coal operators in the State were Arch Minerals Corp. and Amax Coal Co., a subsidiary of American Metal Climax, Inc. (Amax).

Arch Minerals Corp. began shipping coal in March from the 20-foot-thick coal bed at the Seminoe No. 1 strip mine. During the year, development work began on the Seminoe No. 2 strip mine, and about 120,000 tons were produced, according to the State Inspector of Mines. Each mine is expected to eventually produce about 3 million tons annually. The company's production in 1972 was sent by unit trains, each hauling about 10,000 tons of coal, to powerplants of Commonwealth Edison Co. in Hammond, Ind., and Waukegan, Ill. Arch Mineral Corp. is a joint venture comprised of Ashland Oil and Chemical Co. and H. L. Hunt.

Amax Coal Co. began production in late 1972 from the Belle Ayr strip mine in the Gillette field of the Powder River Coal Region. The State Inspector of Mines reported the company's output at almost 33,000 tons, which was shipped for testing purposes. The first unit train coal shipments under a 20-year contract with the Public Service Co. of Colorado to supply a powerplant at Pueblo, Colo., are scheduled to start June 1973. Production is expected to rise from about 1.5 million tons in 1973 to about 2.5 million tons the following year. Most of the output will be for the powerplant. Amax has about 4,000 acres of land containing coal beds up to 70 feet thick; coal reserves have been estimated at about 450 million tons. The Belle Ayr mine is the company's first development on its holdings of coal reserves in the Western States. Beginning in 1976, three unit train coal shipments, each totaling 11,000 tons, will be made weekly from the mine to a powerplant being built by Southwestern Electric Power Co. at Cason, Tex. The contract is for deliveries totaling 42.5 million tons. The 1,483-mile haul from the mine to the powerplant will probably rank as the longest unit train coal-haul in the nation.

During the year, Burlington Northern Inc., built a 17-mile spur line to the Belle Ayr mine at a cost of $3.5 million. The company also requested permission from the Interstate Commerce Commission to build a 126-mile branch in the Powder River Coal Region. The line, which will cost about $32.5 million, will serve the coal mines in the area.

Kemmerer Coal Co. increased production from its Sorensen mine to 1.8 million tons largely to meet the needs of the Naughton powerplant of Utah Power & Light Co., which began operating a third unit in August.[10] Kemmerer's output in 1973 is estimated to reach 2.7 million tons or more. The Sorensen mine was about 250 feet deep, 3,770 feet wide, and 5,200 feet long. It will eventually reach a depth of about 1,000 feet.

Energy Development Co., a subsidiary of Iowa Public Service Co., began production in the Hanna Coal Region from a new underground mine, the Vanguard No. 1. It installed a 36-inch-wide, 3-mile-long conveyor belt to transport coal above ground from the mine to a new loading tipple at the railhead. The company also operates strip mines in the area, but it plans to obtain increasingly larger tonnages by deep mining a coal bed that is 7 to 11 feet thick. The deep mine accounted for less than half of Energy's annual output, but its share is expected to rise to about 75% by 1974. According to the State Inspector of Mines, Energy produced about 329,000 tons in 1972. It plans to produce 1 to 1.2 million tons of coal per year, all from the Vanguard mine. Unit train shipments to a powerplant in Sioux City, Iowa, began about April. The trains make the round trip in about 72 hours.

The Big Horn Coal Co., Sheridan County, received the Sentinels of Safety award for the best safety performance under the category of open pit coal mining. The award, which was cosponsored by the Federal Bureau of Mines and the American Mining Congress, was for 238,918 man-hours of work in 1971 without a disabling injury. The company mines a 20- to 44-foot-thick coal bed that is covered by 50 feet or more of overburden. About 140 acres of the mined lands have been reclaimed. One of the restored areas has been designated a State park. According to the State Inspector of Mines, Big Horn Coal Co. produced about 954,000 tons in 1972.

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[10] Riverton Ranger. 18th Annual Wyoming Mining and Industrial Progress Issue. V. 67, No. 75, June 14, 1973, p. 10–B.

In October, Union Pacific Corp. and Arch Mineral Corp. formed the Medicine Bow Coal Co. A surface mine is planned in the Hanna Coal Region. Production is scheduled for 1974 at the rate of about 2½ to 3 million tons per year.

Late in the year the Muddy Creek Mines Corp. was formed to strip mine the coal reserves of an old underground operation, the Welton mine, north of Pavillion and Pilot Butte in Fremont County. The company's output will be used locally.

The Rocky Mountain Associated Coal Corp., formed in 1971, was dissolved in July, and operations were terminated at the company's Reliance strip mine, near Rock Springs, by mutual consent of Union Pacific Corp. and Eastern Gas and Fuel Associates, the holding companies. The action was taken because the coal loading and crushing facilities did not comply with Wyoming's air quality standards. The companies decided that future prospects for the mine did not justify the additional expenditures needed to meet the standards.

The Gunn-Quealy Coal Co., a subsidiary of Kemmerer Coal Co., was building a 65-foot rotary coke plant costing $2.5 to $4 million at Rock Springs, where the company has operated a pilot plant since 1964. Salem Corp. of Pittsburgh, Pa., was the contractor for the new plant. An underground mine, the Rainbow No. 8 mine, was being developed to supply coal to the plant. The company's Rainbow No. 7 underground mine was scheduled to be closed in 1973.

FMC Corp. expanded the annual capacity of its coke plant at Kemmerer from 50,000 tons to 85,000 tons. Air pollution equipment was installed to meet environmental standards. FMC shipped 3,000 tons of coke briquettes from the plant to Cardiff, Wales, United Kingdom. British Steel Corp. will make blast furnace tests on the coke, which is made from noncoking subbituminous coal by a special process.

The fourth and final unit of the Dave Johnston powerplant, near Glenrock, began operation during the year, giving the plant a total capacity of 750 megawatts. The new unit has a cooling tower to condense spent steam from the turbine and a wet scrubber to remove particulates from stack emissions. Plans were underway to install wet scrubbers on the other three units, which have mechanical dust collectors, and to build another cooling tower. The cost of the project was estimated at $31 to $37 million. Pacific Power & Light Co. mines a coal bed averaging 30 feet thick to supply the powerplant's coal requirement of about 8,000 tons per day. Approximately 3 million tons are expected to be produced in 1973, compared with 2.6 million on 1972.[11]

In December, Pacific Power & Light Co. and the Black Hills Power & Light Co. invited bids on major equipment components for a 330,000-kilowatt air-cooled, coal-fired powerplant east of Gillette. The plant will be the largest of its type in the world when it begins operating about 1977. Coal will be supplied from the Wyodak strip mine. A 20,000-kilowatt air-cooled steam powerplant is operating nearby.

The U.S. Department of the Interior released the environmental impact statement for the Jim Bridger powerplant in Sweetwater County. The first 500,000-kilowatt unit is scheduled for service in 1974; about 26% of the unit was completed at yearend 1972. Pacific Power & Light Co. and Idaho Power Co. will mine two coal beds, each averaging 15 feet in thickness, to provide fuel for the plant. The production is expected to total 1.5 million tons in 1974 and reach about 5.5 million tons in 1976.

Western Standard Corp., a minerals and land company, acquired State coal leases, preferential right lease applications, and prospecting permits that cover almost 6,000 acres in Campbell County. Part of the area is along the rail line proposed for the Powder River Coal Region by Burlington Northern. Western Standard will explore the coal resources of the acreage. Previous drilling indicated coal beds up to 25 feet thick at a depth of about 66 feet. The company has other coal properties in the Kaycee area, Johnson County.

During the year, Atlantic Richfield Co. (Arco) began drilling on the coal leases it acquired in 1965 in the Powder River Region. Union Pacific Corp. was engaged in studies pertaining to in situ coal gasification. The company, through its subsidiary, Rocky Mountain Energy Co., holds coal leases with Arch Mineral Corp. and Rosebud Coal Sales Co. Reynolds Metals Co. expects to produce up to 20 million tons of coal per year if its proposed large uranium enrichment plant is approved. The company has coal reserves totaling about 2.2 billion tons near Lake DeSmet.

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[11] Pacific Power & Light Co. 1972 Annual Report. P. 9.

The Wyoming Department of Economic Planning and Development (DEPAD) forecast a rapid development of the coal deposits in the Powder River Coal Region, particularly in Johnson County. They envisage the construction of four coal gasification plants, each costing about $25 million, between 1978 and 1984. According to DEPAD, the Powder River Region could provide fuel for five to 10 large powerplants, the first of which was estimated as being built in 1980.

In October the Federal Bureau of Mines began a $600,000 in situ coal gasification project near Hanna. A coal bed about 30 feet thick and 400 feet underground was drilled so that fluids or chemical explosives can be injected to fracture the coal. Using oxygen, the coal will be ignited, and the resulting gas will be recovered at the surface. The gas is expected to have a low heating value (125 to 150 Btu per cubic foot), but it would be suitable for use as boiler fuel or in utility plant turbines. The purpose of the test is to study the technology and economics of underground coal gasification.

Coal from the Big Horn area was among the coals tested by FMC Corp. at its coal conversion pilot plant at Princeton, N.J., under a contract with the Office of Coal Research. The test of the Wyoming coal reportedly was successful, with a yield of 11.7% oil (by weight), based on dry coal.

The U.S. Geological Survey awarded a $120,000 grant to the Montana College of Mineral Science and Technology Foundation to evaluate some of the low-sulfur coal resources in an area covering 2,000 square miles in the Powder River Basin of Wyoming and Montana. The study will be conducted jointly by the Montana Bureau of Mines and Geology and the Wyoming Geological Survey. The project involves drilling and logging in the Wasatch and Fort Union Formations.

During the year the Bureau of Reclamation proposed building two new reservoirs in Wyoming to provide the water needed to develop coal deposits in northeastern Wyoming and southeastern Montana. Two projects proposed in Johnson County were the Boxelder Reservoir, which would provide about 30,000 acre-feet of water at a cost of about $25.3 million, and the Hole-in-the-Wall Reservoir, which would provide 20,000 acre-feet of water at a cost of about $10.1 million. Water would be delivered to the coal fields by pipelines ranging from 36 to 144 inches in diameter. These reservoirs are among six or eight that have been proposed in Wyoming and Montana.

Several reports about coal in the State were published during the year.[12]

Natural Gas.—Marketed natural gas totaled 375 billion cubic feet in 1972, compared with 380 billion in 1971. However, the value rose to $60.8 million from $58.2 million in 1971. The field production of natural gas in 1972 declined slightly, totaling 384.2 billion cubic feet as compared with 384.3 billion in 1971. Approximately 46% of the field production of natural gas was from public land, compared with 51% in 1971. According to the Wyoming Ad Valorem Tax Division, the major gas producing counties and their share of production were Sweetwater, 23%; Campbell, 21%; Sublette, 19%; and Fremont, 16%.

The Hilight field, Campbell County, continued to be the State's chief gasfield, producing 45.1 billion cubic feet as contrasted with 38.2 billion in 1971. According to the Wyoming Oil and Gas Commission, the largest gasfields in terms of cumulative production through 1972 were as follows: Worland, 408.3 billion cubic feet; Beaver Creek, 314.5 billion cubic feet; Church Buttes, 237.8 billion cubic feet; Tip Top, 188.5 billion cubic feet; Elk Basin, 183.4 billion cubic feet; and Hogsback, 170.5 billion cubic feet. The Church Buttes field produced from a depth of 18,050 to 18,200 feet, the deepest in the State.

The American Gas Association (AGA) reported that Wyoming's natural gas reserves totaled 4.09 trillion cubic feet at yearend 1972, a slight decline as compared with 4.13 trillion cubic feet the previous year. The State's reserves ranked second in the Rocky Mountain Region after New Mexico.

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[12] Averitt, P. and L. Lopez. Bibliography and Index of U.S. Geological Survey Publications Relating to Coal, 1882–1970. U. S. Geol. Survey Bull. 1377, 1972, 173.
Glass, G. B. Mining in the Hanna Coal Field. Geol. Survey of Wyo. 1972, 45 pp.
———. Review of Wyoming Coal Fields, 1971. Geol. Survey of Wyo. 1972, 32 pp.
———. Midyear Review of Wyoming Coal Fields, 1972. Geol. Survey of Wyo. 1972, 43 pp.
Gomez, M. and D. J. Donaven. Forecasting the Properties of Coal Seams in Place. BuMines RI 7680, 1972, 53 pp.
Smith, J. B., M. F. Ayler, C. C. Knox, and B. C. Pollard. Strippable Coal Reserves of Wyoming. BuMines IC 8538, 1972, 51 pp.
U.S. Bureau of Mines. Cost Analyses of Model Mines for Strip Mining of Coal in the United States. BuMines IC 8535, 1972, 116 pp.

According to a report released in December, the Green River Basin has the potential of becoming the most important gas producing area in the Rocky Mountain Region when its gas reserves are fully developed.[13] The total presently known gas reserve in the basin was estimated at 3.7 trillion cubic feet, about 56% of which was in the Big Piney-La Barge area. Reportedly, the ultimate discoverable gas in the basin could reach 65 trillion cubic feet, assuming that 40% of the basin's rock volume will be explored and that future drilling will discover as much gas per well as past drilling. In 1971 the natural gas marketed from the basin totaled 160.2 billion cubic feet. Of this, 33.6 billion cubic feet was consumed in Wyoming, including 17.5 billion cubic feet by the State's sodium carbonate industry, whereas the remaining 126.6 billion cubic feet was transported out of the State.

During the year, Davis Oil Co. signed a long-term contract that committed its gas reserves to McCulloch Interstate Gas Co. Davis has about 225,000 acres of oil and gas leases in the Powder River Basin of Wyoming and Montana.

The Butcher Knife Spring gas well of Mountain Fuel Supply Co., a new discovery in Uinta County, established a depth-of-production and depth-of-casing record by reaching a total of 18,844 feet, which surpasses the record set in 1967 by the company's Church Buttes well, about 9 miles to the north. Initial tests resulted in a flow of 5.7 million cubic feet per day of natural gas and 300 barrels per day of condensate from a depth of 18,200–18,280 feet in the Morgan Formation (Pennsylvanian age). Gas was also produced from the Dakota Formation (Lower Cretaceous age), which was reached at 12,756 to 12,828 feet.

Colorado Interstate Corp. completed a 137-mile, 16-inch gas pipeline in the Big Horn Basin from Powell to Lost Cabin, near Shoshoni, where it connects with an existing line of the company. The new line will be supplied with gas from the Elk Basin, Silver Tip, and Oregon Basin fields. The fields have reserves totaling about 145 billion cubic feet.

In October, Western Transmission Corp., a subsidiary of Westrans Industries, Inc., constructed a pipeline extension to the Deep Creek field. Deliveries began in November at the rate of about 10 million cubic feet per day.

According to the AGA, Wyoming had 6,448 miles of natural gas pipeline at the beginning of 1972. The total included 1,036 miles of field and gathering line, 3,248 miles of transmission line, and 2,164 miles of distribution line.

In October, a meeting concerning the inadequate gas supply to some Wyoming consumers was held by the Wyoming Public Service Commission, the Wyoming Legislative Service Agency, Mountain Fuel Supply Co., and the trona industries. The meeting was to develop legislation to help resolve the problem.

Still under consideration during the year was Project Wagon Wheel, a nuclear test proposed by the Atomic Energy Commission (AEC) and El Paso Natural Gas Co. that is intended to stimulate the recovery of natural gas in Sublette County. The proposed test, scheduled near Pinedale for 1974 or later, would involve the detonation of five 100-kiloton nuclear devices at depths ranging from 9,220 to 11,570 feet to fracture gas reserves in dense rock.

Analyses of natural gas from the Riverton field in Fremont County, and the Antelope and Masterston fields in Sweetwater County were published by the Bureau of Mines.[14]

Natural Gas Liquids.—The production of natural gas liquids rose to 10.7 million barrels, compared with almost 8 million barrels in 1971. The value rose to $24.5 million, up from $17.5 million the previous year. Most of the rise in production was in LP gases, which reached 7.7 million barrels during the year as compared with 5.5 million barrels in 1971. In 1972, 17 companies operated gas processing plants in Wyoming. There were 26 plants operating in December. According to AGA, Wyoming's productive capacity of natural gas liquids was 39,000 barrels per day at year-end 1972.

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[13] Wyoming Department of Economic Planning and Development, Mineral Development Division. Natural Gas Resources, Green River Basin, Wyoming. December 1972, 14 pp.

[14] Cardwell, L. E., and L. F. Benton. Analyses of Natural Gases, 1971. BuMines IC 8554, 1972, 163 pp.

Table 7.—Wyoming: Field production of natural gas, by major field
(Million cubic feet)

Field	County	1971	1972
Hilight	Campbell	38,240	45,102
Beaver Creek	Fremont	19,211	19,496
Elk Basin	Park	20,645	18,961
Hogsback	Sublette	17,417	16,968
Canyon Creek	Sweetwater	16,604	15,524
Worland	Washakie	13,857	14,233
Tip Top	Sublette	13,955	13,458
Desert Springs	Sweetwater	11,779	12,916
West Side Canal	Carbon	11,170	10,133
Table Rock	Sweetwater	10,044	9,299
Recluse	Campbell	11,427	9,068
Church Buttes	Sweetwater	8,356	7,941
Riverton, East	Fremont	8,492	7,463
LaBarge, Deep	Sublette	7,298	7,406
Kitty	Campbell	8,782	7,136
Monell	Sweetwater	7,432	6,728
Green River Bend	Sublette	6,670	6,467
Madden	Fremont	7,304	6,184
Dry Piney	Sublette	8,437	6,124
Oregon Basin	Park	5,884	5,507
Little Buffalo Basin	Hot Springs and Park	4,486	5,301
Riverton	Fremont	5,893	4,533
Porcupine	Campbell	1,295	4,274
Birch Creek	Sublette	4,781	4,208
Pavillion	Fremont	4,052	4,034
Other fields		115,953	115,689
Total		384,314	384,153

Source: The Wyoming Oil and Gas Conservation Commission.

Wyoming's proved reserves of natural gas liquids at yearend 1972, as estimated by AGA, totaled 91.2 million barrels. The total was comprised of 46.5 million barrels of nonassociated reserves and 44.7 million barrels of associated-dissolved reserves. Revisions and extensions added 6.2 million barrels to the reserves, whereas new fields added 0.3 million barrels. The reserves in 1972 represent a decline when compared with 97.6 million barrels in 1971 and 111 million barrels in 1970.

Oil Shale.—Two tracts totaling 10,203 acres southeast of Rock Springs were included among the six prototype areas for the proposed oil shale leasing program of the U.S. Department of the Interior. All surface and mineral rights on both tracts are owned by the United States. In September the Interior Department released a three-volume draft environmental statement for the program. Volume 1 describes the regions and the potential environmental impacts. Volume 2 discusses the energy alternatives. Volume 3 describes the selected tracts and the potential environmental impacts.

The Federal Bureau of Mines continued in situ oil shale experiments near Rock Springs, and awarded contracts to conduct exploratory drilling to evaluate oil shale deposits near Rock Springs and Eden. The Bureau's Laramie Energy Research Center continued laboratory studies on all phases of oil shale and shale oil technology, including pilot plant studies for simulating in situ retorting.

Oil shale at a depth of about 400 feet in the Green River Basin was hydraulically fractured in a study to determine the suitability of the technique as a prerequisite for in situ retorting.[15] Data from phase 1 suggest that it can be used to produce multiple, closely spaced horizontal fractures in the oil shale.

Oil yields from oil shale in the Tipton Member of the Green River Formation were reported to average 13.3 gallons per ton but range as high as 22.4 gallons per ton in a rich zone.[16] The 21-foot zone in which the Bureau conducted in situ experiments contains about 34,300 barrels of oil in place per acre. An acre of the 40-foot rich zone in the Tipton Formation contains about 62,000 barrels in place.

During the year the Bureau released a report that evaluated electrical resistivity surveys as a method for detecting rubble zones in oil shale.[17] The surveys were conducted in Sweetwater County.

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[15] Thomas, H. E., H. C. Carpenter, and T. E. Sterner. Hydraulic Fracturing of Wyoming Green River Oil Shale: Field Experiments, Phase I. BuMines RI 7596, 1972, 18 pp.

[16] Dana, G. F., and J. W. Smith. Oil Yields and Stratigraphy of the Green River Formation's Tipton Member at Bureau of Mines Sites Near Green River, Wyo. BuMines RI 7681, 1972, 46 pp.

Petroleum.—Total crude oil production declined to 140 million barrels from 148 million barrels in 1971 and 160 million barrels in 1970, the peak year of production. The major oil producing counties and their approximate share of production, as reported by the Wyoming Ad Valorem Tax Division, were Campbell, 25%; Park, 23%; Natrona, 10%; Fremont, 7%; Hot Springs, 7%; and Sweetwater, 6%. The rankings were the same as in 1971. Approximately 57% of the production in 1972 was from public lands. Although the total output declined, Wyoming's oil production ranked fifth in the Nation and first in the Rocky Mountain Region. The State's cumulative oil production through 1972 reached 3.8 billion barrels.

During 1972, 110.6 million barrels of crude oil was shipped out of the State. Shipments east of the Mississippi River were to Indiana, 28.4 million barrels; Michigan, 8.3 million barrels; Illinois, 7.0 million barrels; Ohio, 5.2 million barrels; and Kentucky and Tennessee, 0.3 million barrels. Other destinations were Kansas, 19.2 million barrels; Montana, 16.4 million barrels; Utah, 11.1 million barrels; Colorado, 10.2 million barrels; and Missouri and Nebraska, 4.4 million barrels. During the year Wyoming received 0.8 million barrels of crude oil from neighboring States, chiefly Colorado, and 1.9 million barrels from Canada.

The State's four principal oilfields, accounting for 29% of the year's output, were Oregon Basin, Salt Creek, Elk Basin, and Hilight. These fields were also major producers in 1971, but the rankings were different except for Oregon Basin. As was anticipated, the production from the Hilight field dropped sharply. Late in the year, parts of the field, which was discovered in 1969, were being waterflooded to aid production. During the year Amoco Production Co. announced plans for a $1 million installation at Elk Basin to reinject 25,000 barrels per day of waste water into the field to increase the ultimate recovery as well as to dispose of the waste water produced with the oil. The field has been in operation since 1915.

According to the Wyoming Oil and Gas Conservation Commission, the Salt Creek field produced about 506 million barrels since its discovery in 1906. Elk Basin, discovered in 1915, produced 347 million barrels through 1972, whereas Oregon Basin, discovered in 1912, had a cumulative output of 217 million barrels. Hence, together, these three fields have been the mainstay of the State's oil production, accounting for about 28% of all the oil produced.

At yearend the reserves of the major fields were estimated as follows: Oregon Basin, 72 million barrels; Salt Creek, 81 million barrels; Elk Basin (including part of the field extending into Montana), 88 million barrels; Hilight, 101 million barrels.[18]

Wyoming's crude oil reserves at yearend 1972, as estimated by the American Petroleum Institute, totaled 949,779,000 barrels, down from 996,985,000 barrels in 1971 and 1,017,359,000 barrels in 1970. Wyoming's crude oil reserves ranked 6th in the Nation, accounting for 2.61% of the total. They were the principal reserves in the Rocky Mountain Region.

The number of exploratory and development wells drilled rose to 964, up from 893 in 1971. The total drilling footage reached 6.5 million feet, compared with 5.3 million feet the previous year. A total of 451 exploratory wells were drilled, of which 61, or 13.5%, were successful. The 513 development wells drilled resulted in 336 producers, a success ratio of 65.5%. Campbell County, with a total of 343 wells and 2.9 million feet of drilling, continued to be the most active area in the State as well as the Rocky Mountain Region. In late December, 83 drilling rigs were operating in Wyoming, compared with 61 the previous year.

Beginning in October and continuing through the remainder of the year, interest was focused on the Brady Unit No. 1 wildcat well in Sweetwater County. Various tests indicated the presence of 170 feet of potential productive strata in the Nugget Formation (Jurassic age) and 270 feet in the Weber-Tensleep Formation (Pennsylvanian age). Tests at a depth of about 12,000 feet in the Nugget Formation achieved a flow of about 2,600 barrels per day of crude oil with a gravity of 52°, and about 3.9 million cubic feet per day of natural gas. Tests at a depth of about 13,500 feet in the Weber-Tensleep Formation resulted in a flow of about 1,100 barrels per day of 53° gravity crude oil, and about 4.7 million cubic feet per day of natural gas. Gas was also reported in several other formations. The drilling continued into 1973, with a total depth planned at about 15,500 feet. In November, two step-out wells, Unit No. 2 and Unit No. 3, started drilling to further evaluate the area. One was about a mile to the northeast of the discovery well, whereas the other was about a mile to the southwest. The Brady Unit wells are on a 39,000-acre tract held by a joint venture comprised of Champlin Petroleum Co., the operator, Mountain Fuel Supply Co., each of which has a 41.25% share, and Amoco Production Co., which has a 17.50% share. Champlin is a subsidiary of Union Pacific Corp. Amoco is a subsidiary of Standard Oil Co. of Indiana.

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[17] Brown, J. W., and R. C. Repsher. Detection of Rubble Zones in Oil Shale by the Electrical Resistivity Technique. BuMines RI 7674, 1972, 17 pp.

[18] Where Giant Reserves Are Found Around The United States. Oil and Gas Journal. V. 71, No. 5, Jan. 29, 1973, p. 110.

During the year Inexco Oil Co. announced plans to start an exploration program that may cost $10 million and cover all of the company's undeveloped leases in the Powder River Basin. Inexco reportedly will contribute about $3 million and will own 25% of each partnership formed. Panhandle Eastern Pipe Line Co. planned to invest about $3 million in carrying out a joint exploration program with Inexco and its partners. Inexco discovered the large Hilight field in 1969.

At yearend, Wyoming's nine operating refineries had a total crude oil throughput capacity of about 139,000 barrels per calendar day, compared with about 132,000 barrels (revised figure) in 1971. They processed 48.7 million barrels of crude oil, including 46.2 million barrels of oil produced in the State. Refinery processing of crude oil, unfinished oils, and natural gas liquids yielded about 53.8 million barrels of petroleum products, compared with about 52 million barrels in 1971. The fuels consumed for all purposes at Wyoming's refineries during 1972 included 573,000 barrels of residual fuel oil, 58,000 barrels of liquefied petroleum gas, 13,809 million cubic feet of natural gas, 10,374 million cubic feet of refinery gas, and 137,000 short tons of petroleum coke. Purchased electricity totaled 127 million kilowatt-hours.

Husky Oil Co., at Cheyenne, completed a $10 million refinery expansion program during the year. The refinery is now capable of producing unleaded gasoline. The new units that went onstream were a 2,400-barrel-per-day alkylation unit, which will increase the output of high-octane gasoline by 1,500 barrels per day; a 5,000-barrel-per-day catalytic reformer for manufacturing 100-octane unleaded gasoline; and a naphtha hydrotreater.

Amoco Oil Co. plans to increase the capacity of its refinery in Casper to produce up to 30 million pounds of wax per year and 700,000 barrels of lubricating oils per year. The refinery is the only one in the Rocky Mountain area that produces those petroleum products.

In September, Arco and Pasco, Inc. entered into an agreement, whereby Pasco will purchase Arco's refinery at Sinclair. The refinery is part of the property Arco agreed in 1970 to sell within 3 years under a settlement with the U.S. Department of Justice concerning Arco's merger with Sinclair in 1969. Pasco is a subsidiary of Studebaker-Worthington, Inc.

On January 1, 1972, stored crude oil became exempt from personal property taxes. The elimination of the tax was provided by a statute passed in 1966 that permitted holders of raw materials to phase out their taxes over a 5-year period. Previously, oil stored in tanks for refining purposes was subject to personal property tax. Crude oil producers will continue to pay a production tax at 100% of the value plus 1% mineral severance tax.

Ten oil companies have agreed to a cooperative aid program to provide quick action to curtain and clean up oil spills. The company responsible for the oil spill would be liable for all expenses. The counties involved in the cooperative agreement are Fremont, Natrona, Converse, Carbon, Albany, Platte, Goshen, and Laramie.

Estimates of the costs of developing and producing crude oil in Wyoming were included in a report published by the Bureau of Mines.[19] A list of Bureau of Mines publications on petroleum and natural gas in Wyoming during 1961–70 is included in a circular released during the year.[20]

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[19] Garland, T. M., and W. D. Dietzman. Engineering Cost Study of Development Wells and Profitability Analysis of Crude Oil Production. BuMines IC 8561, 1972, 125 pp.

[20] Hutchison, V. V. Selected List of Bureau of Mines Publications on Petroleum and Natural Gas, 1961–70. BuMines IC 8534, 1972, 163 pp.

Table 8.—Wyoming: Oil and gas well drilling completions in 1972, by county

County	Proved field wells [1]			Exploratory wells			Total	
	Oil	Gas	Dry	Oil	Gas	Dry	Number of wells	Footage
Albany	1	--	1	--	--	2	4	7,297
Big Horn	28	--	4	--	--	16	48	210,579
Campbell	101	3	86	20	2	131	343	2,888,741
Carbon	1	5	7	--	1	9	23	127,886
Converse	14	1	6	4	--	34	59	459,251
Crook	4	--	11	4	--	9	28	163,705
Fremont	21	6	5	--	2	25	59	264,863
Goshen	--	--	--	--	--	12	12	90,714
Hot Springs	14	--	--	--	--	6	20	92,267
Johnson	6	--	3	--	--	11	20	154,302
Laramie	--	--	2	1	--	9	12	90,809
Lincoln	--	--	1	--	--	1	2	11,825
Natrona	23	1	13	--	--	31	68	285,036
Niobrara	10	1	4	3	--	16	34	198,001
Park	32	4	5	2	--	8	51	222,634
Platte	--	--	--	--	--	1	1	3,660
Sheridan	--	--	--	--	--	9	9	77,665
Sublette	3	5	3	1	2	9	23	163,067
Sweetwater	8	10	11	2	8	30	69	472,806
Teton	--	--	--	--	--	1	1	4,316
Uinta	--	--	--	--	1	4	5	42,593
Washakie	15	--	3	1	--	5	24	183,646
Weston	19	--	12	7	--	11	49	290,447
Total	300	36	177	45	16	390	964	6,506,110

[1] Development wells as defined by American Petroleum Institute.

Source: American Petroleum Institute.

Table 9.—Wyoming: Production of crude petroleum, by major field

(Thousand 42-gallon barrels)

Field	County	1971	1972
Oregon Basin	Park	12,230	12,135
Salt Creek	Natrona	11,165	11,722
Elk Basin	Park	12,154	9,952
Hilight	Campbell	11,303	6,631
Lost Soldier	Sweetwater	4,870	4,532
Hamilton Dome	Hot Springs	4,475	4,286
Garland	Big Horn	3,668	4,225
Grass Creek	Hot Springs	3,733	3,406
Little Buffalo Basin	do	3,713	3,385
Winkleman	Fremont	3,319	3,335
Frannie	Park	2,342	2,446
House Creek	Campbell	564	2,440
Monell	Sweetwater	2,022	2,061
Raven Creek	Campbell	1,446	2,025
Byron	Big Horn	1,883	1,903
Big Sand Draw	Fremont	1,906	1,705
Wertz	Carbon	1,674	1,611
Osage	Crook	1,487	1,563
Glenrock, South	Converse	2,010	1,561
Steamboat Butte	Fremont	1,664	1,531
Cottonwood Creek	Washakie	842	1,420
Recluse	Campbell	1,972	1,342
Sussex	Johnson	1,538	1,300
Dry Piney	Sublette	773	1,201
Gas Draw	Campbell	1,542	1,171
Other fields		53,819	51,122
Total		148,114	140,011

Source: Wyoming Oil and Gas Conservation Commission.

Table 10.—Wyoming: Principal oil and gas discoveries in 1972

County and field	Operator	Producing formation	Total depth (feet)
CRUDE OIL			
Campbell:			
Bone Pile	Midwest Oil Co. & Jerry Chambers	Minnelusa	10,951
Bugher Draw	Sun Oil Co	Ferguson	8,101
Fenton	Inexco Oil Co	Muddy	10,235
Hoover Gulch	Graves Drilling Co	Minnelusa	7,572
Kuehne Ranch, East	Petro-Lewis Corp. & Gower & Parker, Et. Al	do	7,937
Squaw Creek	Davis Oil Co. & Exeter Drilling & Exploration Co.	Muddy	7,480
Wagonspoke	Petro-Lewis Corp	Minnelusa	7,475
Well Creek	Monsanto Co., Inter-American Petroleum Co., Et. Al.	do	8,096
Unnamed	Yates Drilling Co	Sussex and Muddy.	10,181
Converse:			
Don Draw	Inexco Oil Co	Parkman	11,509
Poison Draw	do	Teckla	10,470
Tepee	Carl Oil & Gas Co	Niobrara	3,311
Unnamed	Y-H-S Group	Teckla	6,550
Crook:			
Kiehl	Petroleum, Inc	Minnelusa	6,485
Lad	True Oil Co	do	6,404
Reynolds Ranch	Raymond T. Duncan	do	6,550
Laramie: Brush	Rainbow Resources	Muddy	9,667
Park: Unnamed	Oil Development Co. of Texas	Dinwoody, Phosphoria and Tensleep.	4,700
Sweetwater: Whitefeather	Colorado Oil & Gas Corp	Mesaverde	9,005
Weston: Frog Creek	Fred S. Jensen & Anson Mark	Muddy	8,442
NATURAL GAS			
Fremont: Girrard	Mountain Petroleum Co., Ltd	Muddy and Dakota.	1,204
Lincoln: Wilson Ranch	Amoco Production Co	Frontier	12,692
Sublette: Bird Canyon	Mountain Mineral Corp. & Westrans Petroleum Co.	Frontier and Bear River.	9,486
Sweetwater:			
Airport	Kenneth D. Luff	Frontier	3,652
Lost Creek	Cities Service Oil Co	Lewis	9,905
Unnamed	Terra Resources-Reading & Bates	Almond-Lewis	4,549
Uinta: Butcher Knife Springs	Mountain Fuel Supply Co	Morgan	18,844

Source: Petroleum Information Corp., 1972 Résumé, Oil and Gas Operations in the Rocky Mountain Region.

During the year the U.S. Geological Survey published a bibliography of asphalt-bearing rocks and included references to deposits in Wyoming.[21]

NONMETALS

Cement.—According to the State Inspector of Mines, Monolith Portland Midwest Co. in Laramie, the only cement company in Wyoming, produced 199,762 tons of cement during the year. Shipments of cement declined by a little more than 1%, but they rose about 6% in value. Almost all the shipments were of portland cement; masonry cement comprised less than 1% of the total. Consumption of portland cement in the State totaled 193,507 tons, compared with 166,944 tons in 1971. Consumption of masonry cement rose to 2,253 tons from 1,680 tons the previous year.

The dust precipitator installed at Monolith's plant reportedly collected an average of 119 tons of cement dust per day. About 109 tons of the precipitated dust was being used to backfill the company's limestone quarry. The remaining 10 tons was being recycled in the kiln. The company plans to install an oxygen supplement unit to the kiln to help convert sulfur and lime dust into calcium sulfate in the clinker, thereby reducing the amount of dust to be recycled.

Wyoming Prestress Co. began operations during the year in Cheyenne. The company is a subsidiary of Prestressed Concrete of Colorado, Inc., which is wholly owned by Stanley Works, New Britain, Conn. It serves southern Wyoming, northern Colorado, and western Nebraska with a wide range of solid-and hollow-core concrete components for industrial, institutional, and residential buildings. The company expected to have more than $1 million in sales in 1972.

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[21] Mullens, M. C., and A. E. Roberts. Selected Annotated Bibliography on Asphalt-Bearing Rocks of the United States and Canada, to 1970. U.S. Geol. Survey Bull. 1352, 1972, 218 pp.

Clays.—The production of clays rose to 1,873,000 tons, thereby reversing the downtrend that began in 1970. The output in 1972 consisted of 1,811,000 tons of bentonite and 62,000 tons of common clay and shale. Eight companies mined bentonite, and three mined common clay and shale. Production was from Big Horn, Crook, Johnson, Natrona, Uinta, and Weston Counties. Crook County was the leading producer, with 777,000 tons, or about 42% of the State's total. Next was Big Horn County, with 642,000 tons, or about 34% of the total. Wyoming continued to be the Nation's major source of bentonite.

A dust collector was installed at the bentonite plant of Kaycee Bentonite Corp., Johnson County. It was reported to remove about 35 pounds of bentonite dust each hour.

The Federal Bentonite Co. Division, a subsidiary of Youghiogheny & Ohio Coal Co., was installing dust control systems in its plants at Colony, Crook County, and at Upton, Weston County.

Wyoming's zeolite resources were reported as having the potential for the development of a new mineral industry.[22] The zeolites are envisaged as being used as molecular sieves for a variety of purposes, particularly for removing radio-active products and other materials from waste discharges. Zeolites occur in Carbon, Fremont, Hot Springs, Natrona, and Sweetwater Counties.

Feldspar.—The Quien Sabe feldspar mine on Copper Mountain and the 100-ton-per-day processing mill, both north of Shoshoni, Fremont County, were reopened during the year by Modern Mining and Milling, Inc. They had been owned by Northwestern Feldspar Corp., which went bankrupt in late 1971. Production from the new operation, the only one in the State, was about 47% less in tonnage and 44% less in value than in 1971. This ranked Wyoming eighth among the nine States that produced feldspar in 1972. The main ore reserves at the mine were estimated at ½ million tons.[23] Modern Mining and Milling worked the deposit selectively. The ground feldspar produced at the mill, which is about 12 miles southwest of the mine, was used in scouring soaps and abrasives. A large part of the company's output was shipped to the Faultless Starch Co., Kansas City, Mo., for use as a polishing cleanser and a brightener for aluminum, copper, and stainless steel. Feldspar mining in Fremont County began in 1970. The mineral had been mined in Albany and Natrona Counties from 1965–68.

Gem Stones.—The value of gem stones produced in Wyoming reached $142,000, which ranked the State fifth among the 38 States with recorded production in 1972.

During the year Norco Oil Corp. of Minneapolis and Felco Jewel Industries, Inc. of New York formed the Majestic Jade Co. in Riverton, Fremont County, to develop jade deposits near Jeffrey City, about 50 miles to the southeast. The deposits were discovered about 1943. Exploratory drilling by the company reportedly has located at least 3,500 tons of jade estimated to be worth more than $66 million. Preliminary, surveys reportedly indicated a 25-year supply at a production rate of about 250,000 pounds per year. The jade, which is exposed, will be quarried and then sorted at the plant in Riverton. Plans called for an initial production rate of up to 150,000 pounds of raw jade in 1972. The company shipped about 10,000 pounds of jade to the Felco Jewel Industries, Inc., plant in Albuquerque, N.M., for manufacture into jewelry and decorator items. Jade is Wyoming's official mineral. Wyoming jade compares favorably with the nephrite variety from China.

According to an article published during the year, Wyoming's jade region covers parts of Sublette, Fremont, Natrona, Converse, and Carbon Counties.[24] The area near Rawlins reportedly is the State's principal source of raw and finished jade.

Articles were published about agates[25] at Delaney's Rim, near Tipton, Sweetwater County, and petrified wood of gem quality[26] in the western part of the State.

Gypsum.—Wyo-Ben Products, Inc., which had mined gypsum in Big Horn County, stopped operations during the year. There were, consequently, only three active producers in 1972, one each in Albany, Big Horn, and Park Counties. The total output rose, however, thereby continuing the upward trend of recent years. Park and Big Horn Counties accounted for more than 90% of the year's output. According to the State Inspector of Mines, Big Horn Gypsum Co., near Cody, and Georgia-Pacific Corp., in Lovell, produced 140,000 tons and 126,000 tons, respectively. Wyoming ranked 12th among the 21 States that produced gypsum in 1972.

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[22] Surdam, R. C. Economic Potential of Zeolite-Rich Sedimentary Rocks in Wyoming. Wyo. Geol. Assoc. Earth Science Bull., V. 5, No. 1, March 1972, pp. 5–8.

[23] Page 7 of work cited in footnote 6.

[24] Sheppard, K. R. Wyoming Jade. Lapidary J., V. 25, No. 12, March 1972, pp. 1596, 1598, 1600, 1602–1604, 1606–1608.

[25] Hodges, K. Wyoming's Storehouse of Agates. Lapidary J., V. 26, No. 9, December 1972, pp. 1360–1364.

[26] Dickerson, P. and F. The Woods of Wyoming. Lapidary J., V. 26, No. 7, October 1972, pp. 1078–1082.

Plans were announced for the development of a $5 million gypsum mining and processing industry near Thermopolis, Hot Springs County. The gypsum deposits were being evaluated by drilling and core sampling. The new industry will need a labor force of about 110 persons.

Lime.—Holly Sugar Corp. and Great Western Sugar Co. continued to be Wyoming's only producers of lime, which was used in the State for sugar refining. The total output increased, surpassing the record production in 1968 by about 7%. The producing counties, according to rank, were Goshen, Washakie, and Big Horn.

Phosphate Rock.—The marketable production of phosphate rock decreased about 10% in tonnage and 12% in value as compared with 1971. The Leefe mine of Stauffer Chemical Company of Wyoming in Lincoln County, remained the State's only producer. The State Inspector of Mines reported that the mine production of phosphate rock totaled about 305,000 tons. As in previous years, the processing plant at Sage also treated ore from the company's Cherokee mine in Utah. A large part of the plant's output was exported to Canada.

Pumice.—During the year, two companies in Campbell County mined pumice (cinder or clinker beds) for use in road construction.

Sand and Gravel.—The number of sand and gravel operations and the total output both declined in 1972. However, the total value rose to $14.9 million from about $8.8 million in 1971. Sand production rose slightly, totaling 3.25 million tons as compared with 3.22 million tons in 1971. The average price of sand reached $1.95 per ton, more than double the value of 84 cents per ton in 1971. Gravel production dropped to about 5.8 million tons in 1972 from 6.6 million tons the previous year. However, the average price per ton of gravel increased to $1.47 from about 92 cents in 1971. Government-and-contractor operations accounted for about 60% of the total tonnage of sand and gravel and 72% of the value. A major part of the tonnage was used in paving.

Table 11.—Wyoming: Sand and gravel sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972		
	Number of mines	Quantity	Value	Number of mines	Quantity	Value
Albany	14	732	597	9	606	489
Big Horn	6	466	378	5	147	114
Campbell	1	W	W	1	160	96
Carbon	5	W	W	8	685	1,089
Converse	3	382	309	5	239	123
Crook	2	151	W	3	381	88
Fremont	11	1,645	1,328	10	291	273
Hot Springs	5	35	43	2	18	54
Johnson	6	363	213	6	386	258
Laramie	13	406	417	8	315	372
Lincoln	7	761	742	3	75	62
Natrona	12	472	275	7	589	316
Niobrara	2	19	21	3	194	289
Park	[r] 11	644	634	5	208	142
Platte	6	112	52	3	W	94
Sheridan	5	387	302	4	150	98
Sweetwater	5	370	408	10	354	532
Teton	3	103	133	4	W	W
Uinta	2	W	W	2	174	110
Washakie	7	419	419	4	70	67
Undistributed [1]	[r] 14	2,354	2,479	18	4,055	10,248
Total [2]	[r] 140	9,820	8,750	120	9,098	14,916

[r] Revised. W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes Goshen, Sublette, Weston, and some sand and gravel that cannot be assigned to specific counties.

[2] Data may not add to totals shown because of independent rounding.

Table 12.—Wyoming: Sand and gravel sold or used by producers, by class of operation and use

(Thousand short tons and thousand dollars)

Class of operation and use	1971		1972	
	Quantity	Value	Quantity	Value
Commercial operations:				
Sand:				
Building	228	299	427	607
Fill	22	13	43	W
Paving	176	145	W	W
Other uses	25	25	384	338
Total	451	482	854	945
Gravel:				
Building	332	424	597	773
Fill	60	40	122	88
Paving	2,810	2,669	1,400	1,930
Railroad ballast	W	W	W	306
Miscellaneous	207	48	277	80
Other uses	449	342	429	20
Total [1]	3,856	3,524	2,824	3,197
Government-and-contractor operations:				
Sand:				
Building	1	2	2	3
Fill	--	--	2	(2)
Paving	2,765	2,220	2,391	5,386
Other uses	1	3	2	1
Total [1]	2,767	2,223	2,397	5,390
Gravel:				
Building	25	17	2	4
Fill	19	9	11	4
Paving	2,700	2,493	2,983	5,375
Other uses	2	2	27	2
Total [1]	2,746	2,520	3,022	5,384
Total sand and gravel [1]	9,820	8,750	9,098	14,916

W Withheld to avoid disclosing individual company confidential data; included with "Other uses."

[1] Data may not add to totals shown because of independent rounding.

[2] Less than ½ unit.

Sodium Carbonate.—Wyoming continued to rank as the Nation's principal producer of sodium carbonate. According to the State Inspector of Mines, the three trona mining companies had a total output of about 5.1 million tons of trona, from which the sodium carbonate was produced. The producers according to rank were FMC Corp., Stauffer Chemical Company of Wyoming and Allied Chemical Corp. At yearend they had a total production capacity of approximately 3.8 million tons of sodium carbonate per year. The total sodium carbonate processed from the trona in 1972 rose about 13% in tonnage and 20% in value.

During the year FMC added 500,000 tons to its annual production capacity, raising the total to 1.75 million tons. An additional 750,000-ton increase in production capacity was underway and is expected to be on-stream by 1976. The additional capacity originally had been set at 500,000 tons. A fourth mine shaft, 1,600 feet deep, was completed in 1972. It has a hoisting capacity of 6 million tons per year in balanced skips of 23-ton capacity. In December, FMC requested permission from the Wyoming Public Service Commission to construct a 50-mile natural gas pipeline costing an estimated $2 million to the Bird Canyon field in order to obtain a firm supply of 30 million cubic feet of gas per day. FMC's existing gas supply was on an "interruptible" service basis and was subject to periodic shortages during cold weather. During the year the Japanese Ambassador to the United States toured the company's plant at Green River. Japan has expressed an interest in obtaining soda ash from the United States, but no agreements were reported. FMC reportedly is the largest single source of sodium carbonate in the world. The company's labor force in Wyoming totaled 800 to 900 persons.

Stauffer Chemical Co. started its fourth soda ash refinery unit in August. The 500,000-ton-capacity unit raises the total capacity to about 1.5 million tons. The company was mining a trona bed at a depth of 810 feet; a bed at 850 feet was scheduled for development.[27] The beds range from 7 to 14 feet in thickness. In November the Wyoming Public Service Commission granted the company permission to build a $2.5 million, 34-mile natural gas pipeline from its plant to the North Baxter Basin field. The request was based on a need for additional gas supplies on a firm basis. Stauffer also was supplied on an "interruptible" service basis. Its gas requirements were estimated at 30 million cubic feet per day. Work on the line was started late in the year. The company received the Sentinels of Safety Award for 193,287 man-hours worked in 1971 without a disabling injury. The award is cosponsored by the Federal Bureau of Mines and the American Mining Congress.

Allied Chemical Corp. continued its expansion program that is designed to reach an annual production capacity of 1.1 million tons by mid-1973, about double the 1972 capacity, and 2.2. million tons by early 1975. A boiler that can use coal or gas was added to the powerplant at the Green River No. 2 works.[28] A similar powerplant is planned for the Green River No. 3 works. During 1972 Allied leased 13 square miles of trona-containing land from Union Pacific Mining Corp. The new area, which is about 15 miles west of Green River, will provide additional trona for the company's expanding production capacity. Engineering work for construction of a new shaft, 1,600 feet deep, was underway.

The three sodium carbonate producing companies reported that they will spend a total of $10 million for pollution control equipment to meet State and Federal air pollution requirements.

After about 3 years of development work, Texas Gulf, Inc. temporarily halted activities at its mine near Granger because of a lack of a firm supply of natural gas and an uncertain market outlook. The company has two trona beds, each about 10 feet thick, ready for production at depths of 1,370 and 1,450 feet. About 250,000 tons of trona has been mined and stockpiled. The company plans to have a $75 million, 1-million-ton-per-year operation employing about 300 persons starting in early 1976.

Church and Dwight, Inc., continued with a $7.5 million, two-phase expansion program at its Green River plant. The first phase, completed in April, raised the plant's annual capacity to 40,000 tons. The second phase, which is expected to be completed in 1973, will raise the capacity to about 75,000 tons. The company produces Arm and Hammer baking soda from sodium carbonate supplied by Allied Chemical Corp.

The proposed reservoir on the lower Green River in Sweetwater County continued to raise questions regarding its possible effect on the trona mining operations.

A total of about 100 billion tons of trona and halite in beds up to 40 feet thick is present in the Wilkins Peak Member of the Green River Formation.[29] However, approximately 10% to 15% of this is halite intermixed or interlayered with the trona. Halite-free trona beds more than 6 feet thick and underlying more than 25 square miles comprise an estimated 30 to 40 billion tons of trona considered favorable for recovery.

Experiments with mixtures of trona and leonardite from Wyoming indicate that the mixtures have several low-cost uses, such as a soil conditioner or leaf spray, a leaching solution for ionic metal capture, a spray for chemical stability of acid mine tailings, and a surfactant additive to improve secondary recovery of oil.[30]

Stone.—The production of stone in 1972 reached 3.5 million tons, the highest during the 1962–72 period. The average unit price in 1972 was $1.63 per ton, compared with $1.65 the previous year. Granite and limestone together comprised about 80% of the total stone production. The output of granite totaled 1.5 million tons, most of which was used as railroad ballast. The output of limestone was 1.3 million tons, the bulk of which was used for manufacturing cement and in bitumen aggregate. There were 23 operators and 29 quarries active during the year. Ten quarries were for limestone, and 6 were for granite.

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[27] Page 9 of work cited in footnote 10.
[28] Page 11 of work cited in footnote 10.
[29] U.S. Geological Survey. Geological Survey Research 1972. Ch. A, U.S. Geol. Survey Prof. Paper 800–A, 1972, p. A7.
[30] Swanson, V. E., and T. G. Ging. Possible Economic Value of Trona-Leonardite Mixtures, in Geological Survey Research 1972. Ch. D; U.S. Geol. Survey Prof. Paper 800–D, pp. D71-D74.

Basins Engineering Co., Wyoming's largest producer of building and ornamental processed marble, sold 40,000 tons of stone in 1972.[31] The sales reportedly extended as far as Florida and Massachusetts. During the year the company began sales of crushed dolomite, which was used at feedlots in Colorado.

Sulfur.—Shipments of recovered elemental sulfur, a coproduct of sour natural gas, declined to 39,948 long tons from 41,351 long tons in 1971. Park and Fremont Counties together accounted for more than 80% of the total. Other producing counties were Carbon and Washakie. Five plants operated during the year, compared with six in 1971.

METALS

Aluminum.—Aluminum Co. of America purchased for over $1 million a deposit of anorthosite covering about 8,000 acres in the Laramie Mountains, 12 miles northeast of Laramie. The reserves, estimated to total at least 6 billion tons, were acquired as a possible alternative to bauxite as a source of aluminum. The company did not have any immediate plans to substitute anorthosite for bauxite. The anorthosite contains between 25% and 29% alumina, whereas bauxite contains 30% or more. Research on the extraction of alumina from anorthosite date back to World War II, when a 50-ton-per-day pilot plant was operated for a short time at Laramie. During 1953–54 the Federal Bureau of Mines operated the pilot plant and achieved continuous flow production.

Copper.—American Metals Climax (Amax) was planning to develop a copper deposit near Meeteetse, Park County. Exploratory drilling was done during the year. The deposit was first explored in 1960. The development plans are contingent on a favorable outlook in copper markets. If undertaken, the mining operation would provide employment for about 300 persons.

Henrietta Mines, Ltd., of British Columbia, reported encouraging results from drilling on the Copper King deposit, 22 miles west of Cheyenne. Assays from about 335 feet of drilling averaged 0.57% copper and 0.079 ounce of gold per ton. Previous drilling indicated an overall copper mineralization of about 0.32%, with silver averaging about 0.10 ounce and gold 0.05 ounce per ton. The mineralization is in a zone of silicified Precambrian gneiss. The company estimated that the deposit contains 8 million tons of ore. It would probably be developed as an open pit operation with a production of about 5,000 tons per day.

Timberline Minerals of Lander was developing a monzonite porphyry containing copper ore in the Sunlight Basin area north of Cody.[32] The deposit also contains small amounts of gold, silver, and molybdenum. The company reports that $1 million has been spent in the project.

Table 13. Wyoming: Stone sold or used by producers, by county

(Thousand short tons and thousand dollars)

County	1971			1972			Kind of stone produced in 1972
	Number of quarries	Quantity	Value	Number of quarries	Quantity	Value	
Albany	8	W	W	8	1,013	705	Granite, limestone, sandstone.
Big Horn	2	W	W	1	89	62	Traprock.
Carbon	--	--	--	1	189	378	Limestone.
Laramie	2	W	W	3	1,045	2,166	Granite, limestone.
Lincoln	1	283	266	--	--	--	
Natrona	1	80	84	1	122	124	Granite.
Sweetwater	1	146	213	--	--	--	
Teton	2	51	76	3	W	W	Limestone, traprock.
Uinta	1	W	18	1	W	14	Other stone.
Weston	1	54	W	--	--	--	
Undistributed[1]	11	2,280	4,132	11	1,091	2,319	
Total	30	2,894	4,789	29	3,549	5,768	

W Withheld to avoid disclosing individual company confidential data; included with "Undistributed."

[1] Includes production for Crook (1972), Fremont (1972), Park (1972), Platte (1972), and Sheridan Counties and for counties for which no county breakdown is available.

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[31] Page 20 of work cited in footnote 10.

[32] Page 11-A of work cited in footnote 10.

Gold and Silver.—The rising price of gold stimulated an interest in old gold mines in the State. The mining and milling operation of the St. Louis mine, south of Atlantic City, was planned for reopening.[33] It has been closed for about 10 years.

Gold-bearing conglomerates have been identified in several formations in Grand Teton National Park. A small amount of flour gold was found in a quartzite boulder conglomerate 25 feet thick in the Bacon Ridge Sandstone and in the overlying Meeteetse Formation.[34]

Low-grade mineralization containing gold-bearing iron sulfides, silver-bearing galena in veinlets up to 1½ inches thick, as well as copper minerals were reported in faulted and sheared zones in the Keystone area of the Medicine Bow Mountains.[35]

A study of trace elements that may be useful in gold exploration indicated that gold from the Atlantic City district, Fremont County, has a relatively low silver content (5% to 10%), a high copper content (500 to 2,000 ppm), and several diagnostic trace elements, including tin and tungsten.[36]

Iron Ore.—Iron ore shipments rose to 2 million long tons from 1.8 million long tons in 1971. Wyoming's iron ore shipments ranked fifth among the 20 States with reported shipments in 1972. As in previous years, most of the State's shipments were from the Atlantic City open pit mine of United States Steel Corp. in Fremont County. A record 1.5 million long tons of iron ore pellets were shipped from the mine, compared with 1.3 million tons in 1971.[37] CF & I Steel Corp. shipped almost 484,000 long tons from the Sunrise underground mine in Platte County.[38] Maxwell Mining Co., the smallest producer, operated the Shanton open pit mine in Albany County.

According to a report describing the geology of the Atlantic City iron formation, two iron formation units are present in the area: An upper unit about 150 feet thick, which is being mined, and a lower unit about 50 feet thick.[39] Analyses of 23 core samples indicated an average total iron content of 33.45% by weight.

Uranium.—Wyoming's uranium production in 1972 totaled 8.5 million pounds (recoverable content U_3O_8), compared with about 7 million pounds the previous year. The State continued to rank second in the Nation in both output and value. However, its share of the total rose to 33%, up from 28% in 1971.

In 1972, the grade of ore mined in Wyoming averaged 0.21% U_3O_8, but it ranged from 0.05% to 0.32%. There were 28 operations during the year. Carbon and Fremont Counties accounted for about 93% of the total output, with the remainder from Converse and Natrona Counties. The seven uranium ore processing mills in Wyoming had a nominal capacity of 9,050 tons of ore per day. This comprised about 28% of the total for the Nation.

According to the AEC, total drilling for uranium in Wyoming rose to 6.6 million feet in 1972 from 6.1 million feet in 1971. As in previous years, Wyoming ranked first in the Nation in footage drilled for uranium, accounting for about 43% of the total. At yearend, 8.3 million acres were leased for uranium mining and exploration in Wyoming. This comprised about 47% of the total for the country.

AEC reported that Wyoming's uranium reserves (at $8.00 per pound U_3O_8) at yearend 1972 totaled 55.5 million tons of ore averaging 0.18% U_3O_8. The reserves, which are in 137 deposits, contain 97,603 tons of recoverable U_3O_8. Wyoming's uranium reserves rank second in the Nation after those of New Mexico.

During the year Reynolds Metals Co. submitted a proposal to AEC to build a $2.2 billion gaseous diffusion plant at Lake DeSmet, near Buffalo, to enrich uranium fuel for nuclear powerplants. AEC did not rule on the project by yearend. Reynolds plans to form a consortium to finance, build, and operate the proposed plant, which would be the nation's first privately owned uranium enrichment plant. Reportedly, it could be completed by 1978 and in operation by 1980 with a capacity of 8.75

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[33] Page 5 of work cited in footnote 10.

[34] Page A31 of work cited in footnote 29.

[35] Page A32 of work cited in footnote 29.

[36] Page A13 of work cited in footnote 29.

[37] U.S. Steel Western Mines 1972 Iron Ore Shipments. Skillings' Mining Review. V. 62, No. 9, Mar. 3, 1973, p. 4.

[38] CF&I Steel Corp's Iron Ore Shipments 1,470,984 N. T. Skillings' Mining Review. V. 62, No. 12, Mar. 24, 1973, p. 13.

[39] Pride, D. E., and A. F. Hagner. Geochemistry and Origin of the Precambrian Iron Formation Near Atlantic City, Fremont County, Wyoming. Economic Geol. V. 67, No. 3, May 1972, pp. 329–338.

million kilograms separative work units (SWU). (SWU is a measure of the energy required to concentrate the uranium.) By comparison, the capacity of the three existing Government-owned uranium enrichment plants totals 17.1 million kilograms SWU. Reynolds' proposed plant could process about 10,000 tons per year (uranium content) of gaseous uranium hexafluoride. It would cover about 300 acres and employ 2,500 to 5,000 persons. The company owns about 2 billion tons of low-sulfur coal in about 35,000 to 43,000 acres near the proposed plant site. The plant would need 10 to 20 million tons of coal per year to supply a powerplant of about 3,000 megawatts. The company has water rights for about 33 billion gallons per year (100,000 acre-feet), which is considered sufficient to provide an adequate supply of cooling water.

In June, Silver Bell Industries, Inc., and Union Carbide Corp. entered into an exploration and mining lease agreement that provides for 3 months of intensive drilling in a part of Silver Bell's 30,000-acre uranium holdings in the Red Desert area. The new drilling will be next to acreage where previous exploration indicated a potential of 1.5 million pounds of yellow cake (U_3O_8). If the results are satisfactory, Union Carbide will continue to explore and operate the lease.

The mining operations of the joint venture comprised of Petrotomics and Kerr-McGee Corp., Getty Oil Co., and Skelly Oil Co. (KGS) were temporarily phased out, beginning in July, due to an over-supply of uranium, depressed market prices, and licensing delays for nuclear powerplants. Mining operations were scheduled to close by mid-1973, but Petrotomics will continue to operate its 1,500-ton-per-day mill to process ore from the nearby mine of Kerr-McGee Corp.

The Duval Corp. sold its 50% interest in the Morton Ranch joint venture to United Nuclear Corp., its partner since the venture was formed in 1968. The companies were formed to explore and develop uranium ore on a 64,000-acre tract, called the Morton and Boner ranches, in the southern Powder River Basin. Reserves in the tract are estimated at 8 to 13 million pounds of U_3O_8.

Federal-American Partners entered into an agreement with Carolina Power & Light Co. to supply the power company with up to 12 million pounds of uranium oxide. Under the contract, Carolina Power was scheduled to pay Federal-American $3 million before mid-year. Carolina Power has the option of extending the agreement to 1984, which would cover the 12 million pounds of U_3O_8 specified. Federal-American has a 950-ton-per-day mill in the Gas Hills district.

In April, the Tennessee Valley Authority (TVA) purchased for $2 million a 20% interest in the uranium properties of American Nuclear Corp. TVA has an option to increase the share to 50% after two years. TVA made the agreement as part of its long-range plans to obtain fuel for its nuclear powerplants. American Nuclear Corp. has a 40% interest in the uranium mill of Federal-American Partners. In July, American Nuclear purchased 124 uranium mining claims, known as the Peach Group, near Riverton, from Atlas Corp. Indicated and inferred reserves on several of the claims total about 1.5 million pounds of U_3O_8.

AEC released for public comment a draft environmental impact statement on the Highland uranium mill of Exxon Co. (formerly Humble Oil and Refining Co.) in Converse County. After reviewing the comments received, AEC issued the company an operating license. The mill went on-stream in October. Exxon predicted that its plant would produce about 16,000 tons of uranium concentrate over 12 to 14 years, the estimated life of the operation. The company has planned reclamation and restoration activities and has posted a bond with the State totaling $1,000 per acre of tailings for approximately 250 acres. Exxon's mill has a capacity of 2,000 tons per day, the largest in the State. Exxon plans to develop its uranium operation, which is producing about 2,800 tons of ore per day, by mining four pits successively, so that the overburden from the newer pit can be used to fill the older pit. The mining started in June.

Kerr-McGee Corp. started constructing the first mine shaft, which will be about 950 feet deep, to develop its proven uranium reserves in the Powder River Basin. Production is scheduled to start in 1976. A new mill and several additional mines will be required for future development. The company has a 50% interest in the Petrotomics mill.

Utah Construction & Mining Co. started operating a new uranium concentrator in the Shirley Basin. It adds about 2.4 million pounds per year to the company's capacity, thereby doubling its output of uranium oxide.

In October, the sulfuric acid plant of Western Nuclear, Inc., near Riverton, was accused of violating the Wyoming air quality law. The company requested time to correct any deficiencies. The plant produces sulfuric acid for uranium processing mills.

In May, the Federal Bureau of Mines awarded a contract to Knox, Bergman, Shearer Corp., Denver, Colo., for an aerial infrared mapping program of the Gas Hills uranium district. The program is designed to detect subtle differences in ground temperatures.

Several reports on the geology of Wyoming's uranium deposits were published during the year.[40]

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[40] Harshman, E. N. Geology and Uranium Deposits, Shirley Basin Area, Wyoming. U.S. Geol. Survey Prof. Paper 745, 1972, 82 pp.
Rackley, R. I. Environment of Wyoming Tertiary Uranium Deposits. Am. Assoc. of Petrol. Geol. Bull., V. 56, No. 4, April 1972, pp. 755–774.
U.S. Geol. Survey. Geological Survey Research 1972. Ch. A, U.S. Geol. Survey Prof. Paper 800–A, 1972, pp. A8–A9.

Table 14.—Principal producers

Commodity and company	Address	Type of activity	County
Cement:			
Monolith Portland Midwest Co	3326 San Fernando Road Los Angeles, Calif. 90065	Plant	Albany.
Clays:			
American Colloid Co	5100 Suffield Court Skokie, Ill. 60076	Open pit mine and plant.	Big Horn.
		Open pit mine	Crook.
		Open pit mine and plant.	Weston.
Black Hills Bentonite Co	Box 1, Mills, Wyo. 82644	do	Johnson.
		do	Big Horn.
Dresser Industries, Inc., Greybull Dresser Minerals Division.	Box 832 Greybull, Wyo. 82426	Open pit mines and plant.	Do.
International Minerals & Chemical Corp., Eastern Clay Products Dept.	Administration Center Old Orchard Road Skokie, Ill. 60079	do	Crook.
N L Industries Inc., Baroid Division.	Box 1675 Houston, Tex. 77001	do	Do.
		Open pit mines	Weston.
Wyo-Ben Products, Inc	Box 1979 Billings, Mont. 59103	Open pit mine and plant.	Big Horn.
Youghiogheny & Ohio Coal Co., Federal Bentonite Co. Division.	4614 Prospect Ave. Cleveland, Ohio 44103	do	Crook.
		do	Weston.
Coal:			
Kemmerer Coal Co	Frontier, Wyo. 83121	2 strip mines, crushing and oil treatment plant.	Lincoln.
Pacific Power & Light Co	920 S.W. 6th Avenue Portland, Oreg. 97204	Strip mine	Converse.
Gypsum:			
Big Horn Gypsum Co	Box 590, Cody, Wyo. 82414	Open pit mine and wallboard plant.	Park.
Iron Ore:			
CF & I Steel Corp	Box 316 Pueblo, Colo. 81002	Underground mine and beneficiation mill.	Platte.
United States Steel Corp., Western Ore Operations.	Lander, Wyo. 82520	Open pit mine and agglomerator.	Fremont.
Lime:			
The Great Western Sugar Co	Box 5308 Denver, Colo. 80217	Pot kiln at beet-sugar plant.	Big Horn.
Holly Sugar Corp	Holly Sugar Bldg. Colorado Springs, Colo. 80902	Shaft kiln at beet-sugar plant.	Goshen.
Natural gas and petroleum: [1]			
Phosphate rock:			
Stauffer Chemical Company of Wyoming.	636 California Street San Francisco, Calif. 94108	Open pit mine and beneficiation plant.	Lincoln.
Sand and gravel (commercial):			
Boatright-Smith	Box 1129 Casper, Wyo. 82602	Pits and plants	Natrona.
Gilpatrick Construction Co., Inc	Box 973 Riverton, Wyo. 82501	Pit	Sublette.
		Pit	Sweetwater.
		Pit	Washakie.

See footnote at end of table.

Table 14.—Principal producers—Continued

Commodity and company	Address	Type of activity	County
Rissler-McMurry Co., Inc.	P.O. Box 2499 Casper, Wyo. 82602	Pit	Carbon.
		4 pits	Fremont.
		Pit	Natrona.
		do	Niobrara.
Union Pacific Railroad Co.	1416 Dodge Street Omaha, Nebr. 68102	Pit	Albany.
Sodium Carbonate:			
Allied Chemical Corp., Industrial Chemicals Div.	Box 70 Morristown, N.J. 07960	Underground mine and refinery.	Sweetwater.
FMC Corp., Inorganic Chemicals Division.	Box 872 Green River, Wyo. 82935	do	Do.
Stauffer Chemical Company of Wyoming.	Box 518 Green River, Wyo. 82935	do	Do.
Stone:			
The Great Western Sugar Co.	Box 5308 Denver, Colo. 80217	Quarry and plant	Laramie.
Guernsey Stone Co.	Box 337 Guernsey, Wyo. 82214	do	Platte.
Monolith Portland Midwest Co.	Box 40 Laramie, Wyo. 82070	2 quarries and plants	Albany.
Union Pacific Railroad Co.	1416 Dodge Street Omaha, Nebr. 68102	Quarry and plant	Laramie.
Uranium:			
Federal American Partners	Box 991 Riverton, Wyo. 82501	3 open pit mines and mill.	Fremont.
Petrotomics Co.	Drawer 2450 Casper, Wyo. 82601	Open pit mine and mill.	Carbon.
Utah Construction & Mining Co.	Box 911 Riverton, Wyo. 82501	2 open pit mines, leaching operation.	Do.
		2 open pit mines, 2 underground mines, and mill.	Fremont.
Western Nuclear, Inc.	1700 Broadway, Suite 1900 Denver, Colo. 80202	5 underground mines, 1 open pit mine, leaching operation, and mill.	Do.

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[1] Most of the major oil and gas companies and many smaller companies operate in Wyoming, and several commercial directories contain complete lists of them.

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